No. 8075

JVC Service Manual

COLOR PORTABLE VIDEO CAMERA

MODEL GC-4800U

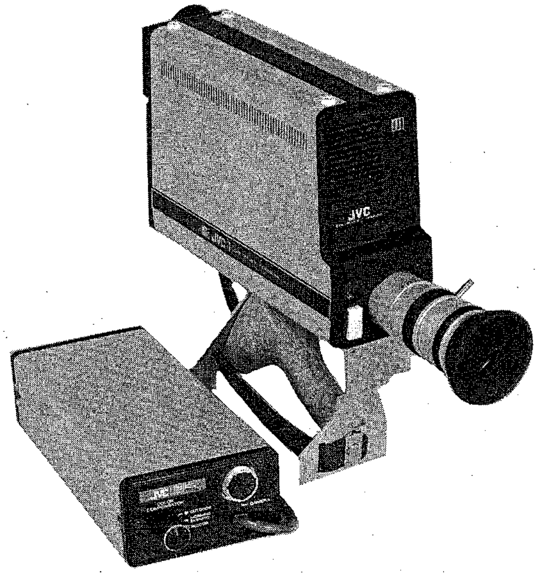
COLOR CAMERA ADAPTER

MODEL GA-20U

JVC INDUSTRIES, INC.
Subsidiary of
Victor Company of Japan, Limited.

JVC

Service Manual



MODEL **GC-4800U**

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SECTION 1
GENERAL DESCRIPTION

1-1 INTRODUCTION

This manual provides service information for the JVC Color Video Camera Model GC-4800U.

The manual describes the principles and adjustments of optical/electrical operations.

Service procedures given herein cover only field maintenance services. Adjustments which require high-level instruments, jigs and techniques are excluded, since they should be performed at a JVC Regional Center for factory service.

Due to design modifications, the servicing procedures and data given in this manual are subject to possible change without prior notice.

1-2 FEATURES

- This high performance camera has automatic gain and color control circuits which compensate for changing conditions. They function equally well indoors and outdoors.
- It has high resolution and sensitivity – more than 400 lines at center with the aperture set to f-2; standard brightness: 100 ft-candles (1,100 lux), minimum brightness: 37 ft-candles (400 lux) – as a result of the independent luminance system.
- Color registration is precise because of the frequency separation color system.
- No warm-up is necessary. The camera is ready for operation 30–50 seconds after the power is switched on.
- The 2/3" regular vidicons provide easy maintenance, low servicing and operating costs.
- It is equipped with a 4X zoom lens, VTR start/stop switch, tally lamp, built-in microphone and 1.5" viewfinder. The viewfinder has an exposure/operation indicator and can be used for recording/playback monitoring. These features make recording very easy.
- The camera control unit is fitted with a color compensation switch which has three positions; outdoor, morning/evening and indoor.
- Plug-in type mounted circuit board assemblies make maintenance very simple.
- The handgrip is convenient for recording as well as monitoring. It can be used as the attachment point for the Camera Support and also for a camera base when utilizing viewfinder for monitoring.
- The viewfinder magnifier eyepiece can be lifted to make monitoring pictures visible for several persons.
- With the battery pack providing power, the GC-4800U can be used with the PV-4800U color portable VTR to make color video recordings. Combined with the GA-20U color camera adapter, the GC-4800U produces NTSC-type color signals which can be recorded on U-VCR equipment or used in an NTSC-type studio video system.

1-3 SPECIFICATIONS

Color system	NTSC-type output, frequency multiplex system
Vidicon tube	2 tube system, 2/3" electrostatic focus, electromagnetic deflection, type 20 PE 14C
Scanning system	525 lines, 2:1 interlace
Horizontal resolution	More than 400 lines at center
S/N ratio	Better than 40dB (Y–ch) at 100ft-candles (1,100 lux)
Minimum practical illumination	37ft-candles (400 lux)
Zoom lens	Special lens mount, 4X zoom (15–60mm) f2 to closed iris
Viewfinder	1.5 inch* electronic viewfinder with aperture indicator. Record, stand-by and playback picture monitoring available
Microphone	Built into camera, 600Ω omni-directional electret condenser microphone
Color temperature	Outdoor; morning and evening; indoor switchable on CCU
CCU connector (10-pin):	
Video output	Composite NTSC-type encoded signal, 1Vp-p, 75Ω unbalanced, sync negative
Audio output	−20dB, high impedance
Horizontal drive input	5Vp-p negative, high impedance
Power supply	12V DC, 1.2A
Start/Stop switch	Built into camera
Tally lamp	Built into camera
Power requirement	12V DC, 1.2A, on camera and CCU supplied from color portable video tape recorder PV-4800U or color camera adapter GA-20U
Operating temperature	32°F–104°F (0°–40°C)
Dimensions: (Camera)	13-3/8"(H) x 3-9/16"(W) x 16-1/8"(D) (339mm x 90mm x 408mm) including lens hood and handgrip
(CCU)	2-13/16"(H) x 4-13/16"(W) x 11-3/4"(D) (70mm x 122mm x 298mm)
Weight: (Camera)	8.4 lbs. (3.8kg) with lens and handgrip
(CCU)	2.9 lbs. (1.3kg)
Standard accessories	Neutral density filter ND-8 (48mm dia.) Camera cap for transport Simulated leather case for CCU Handgrip

Design and specifications subject to change without notice.

*measured diagonally

1-4 PRECAUTIONS

1. Do not subject the GC-4800U to excessive shock or vibration. If the vidicon tubes suffer a severe shock, they will be damaged and the precise optical adjustment may suffer.
2. When the handgrip or tripod is attached to the GC-4800U, make sure the screws are tightened securely.
3. Avoid extremely high or low temperatures, high humidity and strong magnetic fields. These conditions will cause improper white balance and color registration.
4. The vidicon target may burn if the camera is aimed extremely bright objects such as the sun and arc lamps.
5. Replace the lens cap when the GC-4800U is not used, otherwise the vidicon targets may be burned. If the zoom lens is removed, the lens cap must be replaced.
6. When there is dust on the lens surface, clean it with a soft brush or wipe it gently with a soft cloth dampened with alcohol.
7. The GC-4800U camera head and camera control unit are adjusted to operate as a matched pair. If factory service is necessary, both units must be returned.
8. At this time no lens other than that provided with the camera can be used because of the special lens mount.*

1-5 CONTROLS AND CONNECTORS

Description of controls and connectors, with reference to Fig. 1-1 is as follows:

1. Built-in microphone
   Omni-directional highly sensitive condenser microphone. It is automatically disconnected when an external microphone is plugged into the VTR MIC jack.
2. Tally lamp
   Lights when the start/stop switch is set to ON. If a VTR is being used it lights when the VTR is operating.
3. Start/stop switch
   Controls the operation of the VTR.
4. Camera support attachment holes
   To attach the optional GA-16 camera support.
5. Zoom lens
   Specially designed 4X zoom lens.
6. Focus ring
   Rotate to focus. If focusing is difficult, zoom to maximum magnification before focusing.
7. Zoom ring
   Rotate to get the desired composition.
8. Aperture ring
   Controls exposure. Turn this so that the white aperture indicator line is in the center of the viewfinder screen.

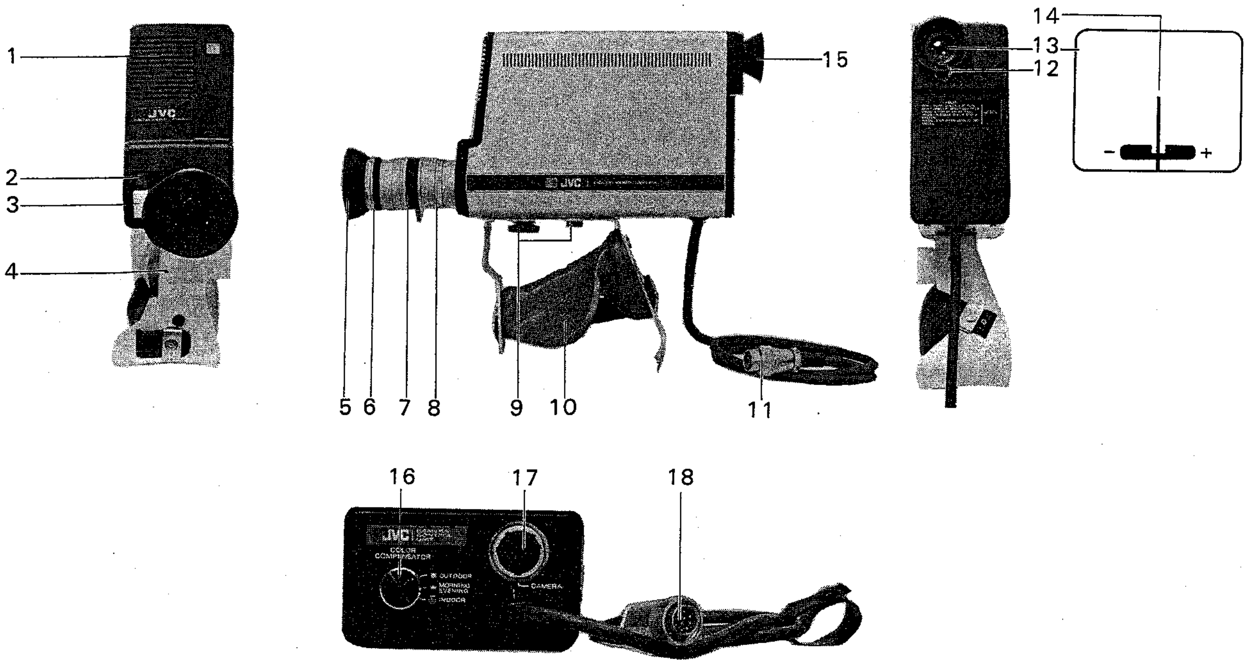

Fig. 1-1 Controls and connectors, model GC-4800U

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*However, tele-conversion, wide angle conversion, zoom-extender, telecine, and microscope attachments are available as optional accessories.

9. Tripod holes
   Attach the handgrip provided or a tripod to these holes.
10. Handgrip
   For holding the GC-4800U when it is used as a hand-held camera. The optional GA-16 camera support used in conjunction with the handgrip provides a very stable camera platform. The handgrip can also be used as a stand when the camera viewfinder is used to monitor playback pictures.
11. Camera connecting cable
   Attached to the camera and connected to the CAMERA terminal of the camera control unit.
12. Viewfinder brightness control
   To be adjusted if the viewfinder picture is hard to see bacause of bright surroundings. In normal operation it should not be adjusted.
13. Viewfinder
   Permits the operator to focus and compose the picture while recording. It can also be used to monitor the playback pictures.
14. Aperture indicator
   This appears as a vertical white line in the viewfinder screen. Adjust the aperture ring until the line is in the center of the screen. The ideal position is midway between the + and – marks in the viewfinder. When the VTR is recording only the lower half of the line will be seen. When using the viewfinder as a playback monitor the line disappears.
15. Eyepiece
   Prevents extraneous light from obscuring the viewfinder image. It may be lifted to permit the viewfinder to be used as a monitor.
16. Color compensator
   Should be set according to the lighting conditions.

OUTDOOR	To be used outdoors in full daylight only. (5800° K – 8000° K)
MORNING/EVENING	To be used outdoors in morning or evening; or indoors under fluorescent lights. (4500° K – 5800° K)
INDOOR	To be used indoors with studio lighting. (3000° K – 3450° K)

17. Camera connection terminal
   Connects to the camera cable of the GC-4800U camera head.
18. CCU connecting cable
   Attached to CCU and connected to the PV-4800U, CR-4400U TV/CAMERA terminal, or the GA-20U CCU/CAMERA terminal.

1-6 OPERATION

Two basic types of operation, for the GC-4800U, color portable system and color camera system, are discussed in the following:

1-6-1 Color Portable System

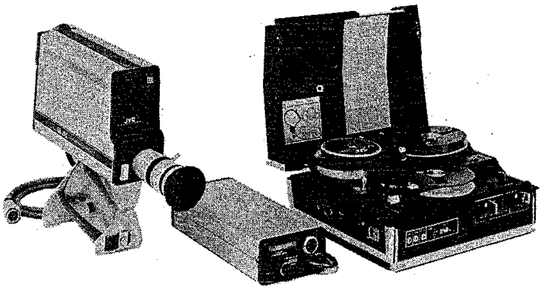

Fig. 1-2

A. Installation and set-up

1. Attach the handgrip to the camera. Remove the rubber cap and mount the zoom lens. (Be careful to keep dust out of the body.) Placing the camera on a horizontal support will help when mounting the lens. See Fig. 1-3.

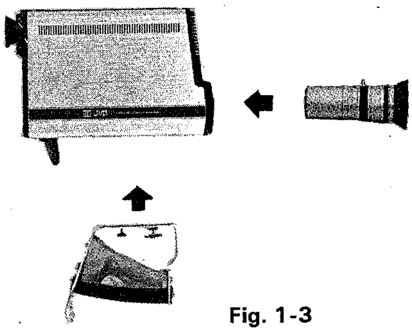

Fig. 1-3

2. With the CCU and the PV-4800U both in their cases, hook the CCU case onto the side of the VTR case.
3. Connect the camera cable to the CCU CAMERA terminal and the CCU connection cable to the PV-4800U TV/CAMERA terminal.
4. Attach the camera cable to the PV-4800U shoulder strap. See Fig. 1-4.

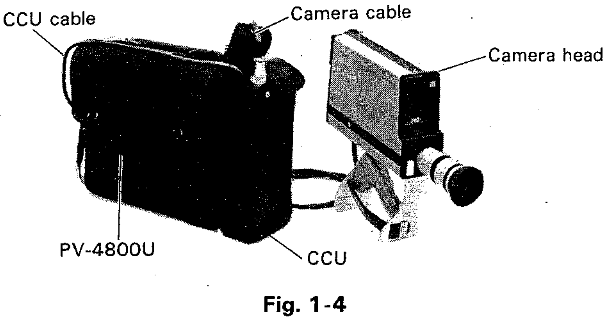

Fig. 1-4

5. Preparing the PV-4800U
   1) Load a fully recharged PBP-1 battery pack or connect the AA-P40U for studio operation.
   2) Load a tape.
   3) Set the TV/CAMERA switch to CAMERA.
   4) Set the mode switch to COLOR.
6. Preparing the GC-4800U camera control unit
   Set the color compensator to:

INDOOR	with studio lighting (3000° K – 3450° K)
MORNING/EVENING	with outdoor morning or evening light or with fluorescent room lighting (4500° K – 5800° K)
OUTDOOR	with outdoor midday light (5800°K – 8000°K)

7. Preparing the GC-4800U camera head
   1) Remove the lens cap.
   2) Attach the ND-8 filter when using outdoors on a bright day.
   3) Switch the start/stop switch to OFF.

B. Operation
1. Preparing to record
   1) Set the PV-4800U to the record mode by moving the function and record levers.
   2) After 30 – 50 seconds the viewfinder will become bright. Turn the aperture ring to increase the aperture, that is towards the smaller f-numbers on the aperture ring. The subject will now be seen in the viewfinder.
   3) Compose the picture by turning the zoom lever and the focus ring. The easiest way to focus is to zoom to closeup, focus sharply and then back the zoom off to compose the scene you want.
   4) There is a vertical white line down the viewfinder screen. The aperture ring must be adjusted until the line is in the center of the picture.

The line appears on the left of the screen when the aperture is too small or the subject too dark. It appears on the right of the screen when the aperture is too great or the subject too bright. The correct position is centered on the viewfinder screen, between the + and – marks.

If the scale of the aperture ring exceeds f-8, a neutral density filter (ND-8 provided, ND-2 or ND-4 optional) should be used.

NOTE: If the aperture is set at more than f-8, the depth of field is too large to obtain a good color picture. If the line is too far to the left, the subject is too dark and the illumination must be increased.

2. Recording
   - o Press the GC-4800U start/stop switch to start recording.
     The PV-4800U will start and record video and audio signals from the GC-4800U.
     When recording only the lower half of the aperture indicator line will be seen and the tally lamp on the front of the camera will light.
   - o While recording, it is not necessary to adjust the aperture ring so the line is in the exact center of the screen as long as the line is between the + and – marks.
     Move the zoom lever and focus ring to obtain the pictures desired.
3. To stop recording temporarily
   To pause during recording, press the GC-4800U start/stop switch to OFF.
   The scene will still be seen in the viewfinder.
   When the start/stop switch is pressed again, recording will resume.
4. When recording is complete.
   When recording is complete, press the start/stop switch to OFF, turn the aperture ring to close the aperture.

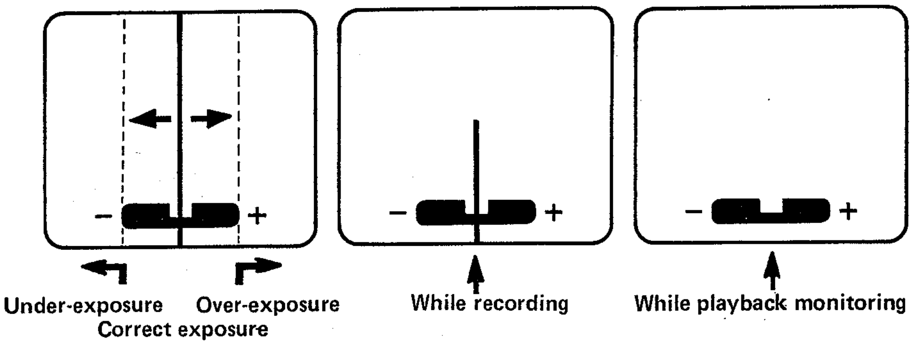

Fig. 1-5 Aperture Indicator in the Viewfinder

Set the PV-4800U function lever to STOP.

NOTE: Setting the PV-4800U function lever to STOP conserves power. When the VTR is left in the pause mode, power from the battery will be consumed.

5. Playback monitoring with the GC-4800U viewfinder

Set the PV-4800U function lever to REW to rewind the tape.

When the tape has been rewound, set it to STOP. Set the function lever to PLAY and press the camera start/stop switch to ON. The playback pictures will be seen on the GC-4800U viewfinder. To monitor the sound, connect an earphone to the PV-4800U EAR jack.

The handgrip is designed so that when the camera is placed on a flat surface it will stand without support. Lifting up the viewfinder eyepiece makes the viewfinder screen more visible when monitoring.

NOTE: To see a still picture, operate the PV-4800U STILL lever. Pressing the camera start/stop switch is not the correct operation for obtaining a still picture.

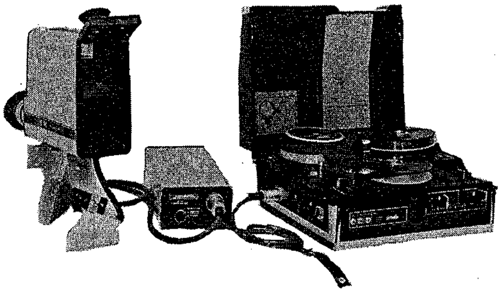

Fig. 1-6

6. Playback monitoring with a regular color TV.

Playback monitoring with a regular color TV is possible if the KR-200U Series color RF converter is installed in the PV-4800U. Connect the PV-4800U RF OUT jack to the VHF antenna input connector of the TV through an antenna switch box. Use the cable provided with the converter. Tune the TV to the appropriate channel depending on the setting of the RF converter.*

NOTE: Refer to the PV-4800U service manual for more details.

*Set to unoccupied broadcast channel in local area.

1-6-2 Color Camera System

The GC-4800U can be used with equipment other than the PV-4800U if the GA-20U color camera adapter is used. Examples of other suitable equipment are the JVC U-VCR video cassette recorders, video mixing consoles, special effect generators and regular color TVs. Refer to the GA-20U service manual for details.

1. For use as a Studio Camera, refer to Fig. 1-7 below:

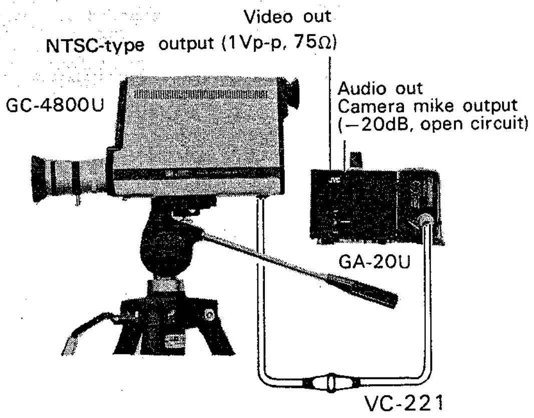

Fig. 1-7

1) Place the camera on a tripod using the mounting holes on the bottom of the camera.
2) Connect the GC-4800U camera head to the CCU with the VC-221 extension cable (32').
3) Fasten the CCU to the side of the GA-20U and plug the CCU connector cable into the GA-20U CCU/CAMERA terminal.
4) Plug the GA-20U power cord into an AC outlet and switch the power on. The color video signals and audio signals from the GC-4800U will now be present at the GA-20U output terminal and can be used as the input signal for a VTR, VCR or other video equipment.

   NOTE: A video cable up to about 70 feet in length may be used with the GA-20U.

2. Recording with the JVC U-VCR. Refer to Fig. 1-8.

1) Connect the GA-20U VIDEO OUT terminal to the VCR VIDEO IN terminal using a coaxial cable. Connect the GA-20U AUDIO OUT to the VCR AUDIO IN with the CN-309 audio cable supplied with VCR.
2) Connect the GA-20U REMOTE terminal to the VCR REMOTE terminal with the optional VC-222 (6.5 ft.).
3) Set the U-VCR to REC LOCK. Now a sequence of scenes can be recorded by merely pressing the GC-4800U start/stop switch.

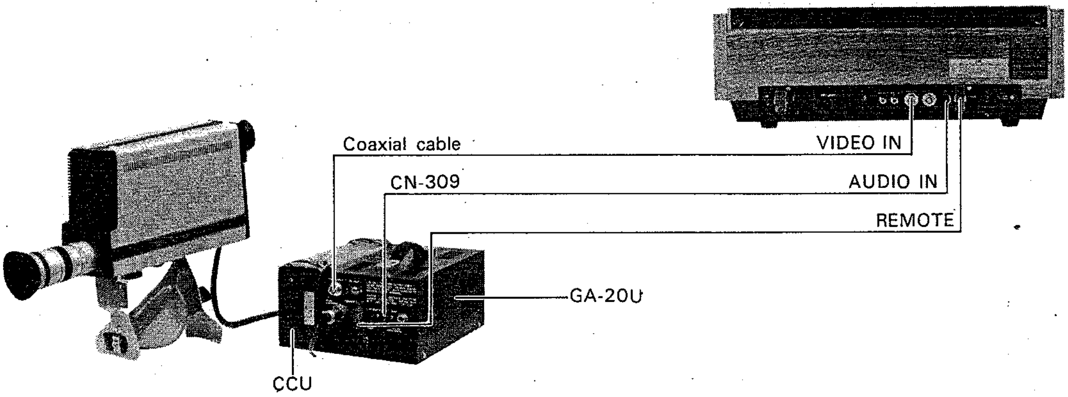

Fig. 1-8

CAUTION:
The VCR will require about 10 seconds for unloading tape when it is stopped. When the start button is depressed to start recording, 10 seconds is required for loading.

Refer to the GA-20U service manual (attached) for more details.

3. Monitoring with Regular Color TV
   To do this it is necessary that the KR-200U Series converter is installed in the GA-20U. If you connect the GA-20U rear panel RF OUT jack to a television VHF antenna terminal through an antenna switch box you can monitor the pictures and sound. Tune to the appropriate channel depending on the RF converter used and its setting.
   Install the converter by opening the case of the GA-20U.

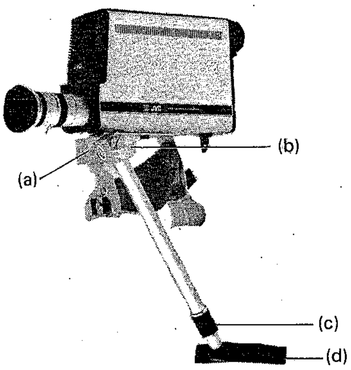

Fig. 1-9

1-6-3 Camera Support GA-16

When using the GC-4800U as a hand-held camera the optional camera support will help you hold it steady for long periods. See Fig. 1-9.

- (a) Attach the camera support to the handgrip with four screws.
- (b) Adjust the angle to your preference.
- (c) Adjust the length of the support until you can easily observe the viewfinder.
- (d) Rest the base of the support on your waist or belt.

1-6-4 Camera Case CB-33U

Cases are provided which hold the GC-4800U camera head and CCU when they are to be stored or transported. When the equipment is in the cases it is still susceptible to shocks, so care is necessary. See Fig. 1-10.

Fig. 1-10

1-7 ADVANCED TECHNIQUES FOR BETTER RECORDING

1. Use of ND Filters
   1) The aperture ring is marked with numbers which indicate f-stops from f-2 to f-8. The larger the f-number, the smaller the aperture. It is possible to close the aperture beyond f-8 to keep the aperture indicator line in the center of the viewfinder screen. However, this is not recommended. Better results will be achieved by attaching the ND-8 (neutral density) filter provided.
   2) In some cases, when the subject is very bright (snow scenes, seashore, etc.) the ND-8 filter may not be sufficient to center the indicator line. In this case additional ND filters (ND-2, ND-4 and ND-8 filters are available from JVC) may be screwed into the ND-8 filter on the front of the lens.*

2. Subject Brightness
   The GC-4800U has been adjusted so that it has a normal color response when the surface of the subject is illuminated by 100 ft-candles (1,100 lux) and has a reflectivity of 70%.
   Optimum performance is obtained if the subject is illuminated uniformly.

3. Direction of Lighting
   When using the GC-4800U outdoors the sun should be behind the cameraman. If the light source is behind the subject, correct adjustment of the aperture will be difficult and the color will suffer.

4. Lighting Hints
   - The surface illumination of the subject being recorded should be around 200 ft-candles (2,150 lux) for optimum results.
   - All parts of the subject should be illuminated equally as far as possible. To do this the distance between the lights and the components that make up the subject should be adequate.
   - The background against which the subject is seen should be light, without causing glare.
   - Shaded areas of the subject should be reduced as much as possible.
     Contrast between the brightest and darkest parts of the subject should be minimal.

   NOTE: o Color studio lamps (3200°K) have limited life especially photo floods, which change in color temperature rapidly with use.
   o Different fluorescent lights have different color temperatures, depending on the type.

5. Reducing Lag
   To reduce lag of pictures to the minimum, the subject should be adequately lighted and the distance between the camera and subject should be appropriate: i.e., the faster the subject is moving the larger the distance.

6. Background Color in the Studio
   The color of the background is very important when recordings are made in studios.
   The color of the studio wall should produce an effect of infinite space and should complement the color of subject and lighting. Normally best performance is obtained from a neutral grey (about 20%).

7. Adjusting the Color Compensator and Use of Conversion Filters
   If you examine photographs of faces taken in the shade and compare them with photographs taken in the sunlight you will notice that the photographs taken in the shade have a blue tint. Whites shift red or blue under different lighting conditions.
   Usually this is not apparent to the human eye, but a camera and film will detect it. The color

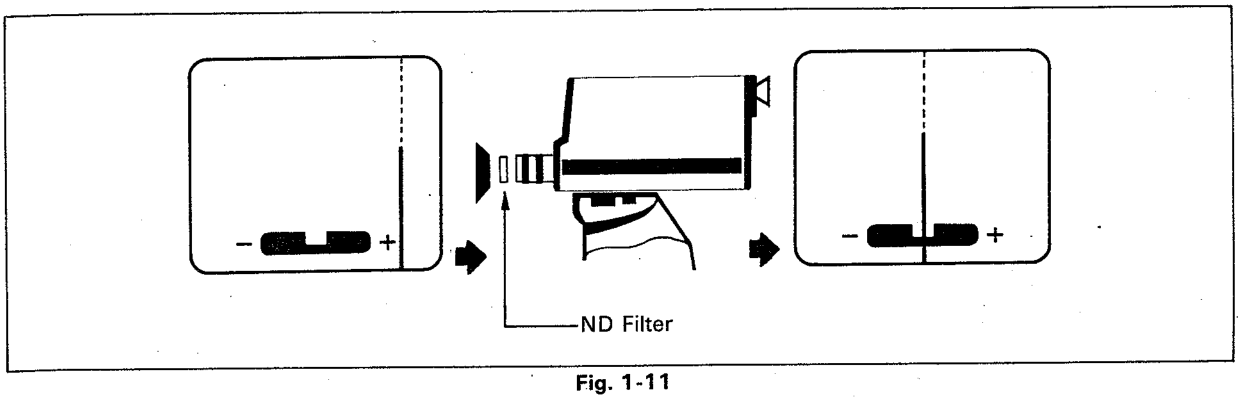

Fig. 1-11

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*Subsection 4-2-1 indicates density and transmission specification for these ND filters.

compensator on the CCU has three positions. These correspond to the color temperatures of the lighting in which the camera will normally be used.This color compensator is all that is necessary for normal use.

If extremely precise color compensation is desired, color compensation filters should be used.

1) Installing conversion filters

   Unscrew the rubber lens hood, screw the filter into the lens and then replace the lens hood. See Fig. 1-12.

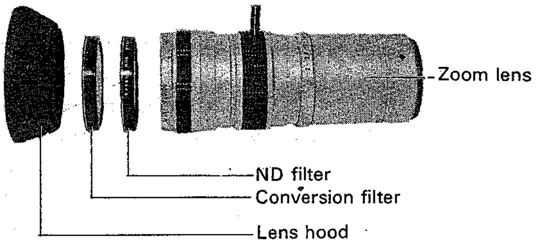


Fig. 1-12

2) Table of Color compensation

CCU COLOR COMPENSATOR SETTING	COLOR TEMPERATURE RANGE	LIGHTING CONDITIONS
INDOOR (3200° K)	3000° K to 3450° K	No compensation is needed for studio lights in this temp. range. Light with a color temperature of less than 3000° K causes a shift to red. To compensate use a blue conversion filter.
MORNING/ EVENING (5100° K)	4500° K to 5800° K	This setting should be used before 10AM and after 4PM in the summer. The hours should be shifted for latitude and season. This is also the correct setting to use with fluorescent lighting or color photo floods. Very early or late outdoor light contains an excessive amount of red. It may be necessary to use a blue conversion filter to obtain correct colors. An amber filter used with the Indoor setting will also compensate for this red shift.
OUTDOOR (6500° K)	5800° K to 8000° K	This setting is used during the middle of the day (approximately 10AM to 4PM). When recording through a window there is a shift to blue. Use an amber conversion filter to compensate. Subjects against a cloudy sky, in rain or shade all tend to shift to blue. Use an amber conversion filter and the OUTDOOR setting.

3) Table of color conversion filters

Filter Type	Color	Application	Filter Type	Color	Application
82A 82B 82C 80D 80C 80B 80A	Blue	A range of filters which are used to raise the color temperature. Select a suitable one depending on the degree of conversion required.	81A 81B 81C 81D 81EF 85C 85	Amber	A range of filters which are used to lower the color temperature. Select a suitable one depending on the degree of conversion required.

Regular 48mm dia. photographic filters can be used with this camera.

SECTION 2
CIRCUIT DESCRIPTION

2-1 GENERAL

The GC-4800U color camera is a two vidicon system which uses frequency separation for the chroma channel. One of the vidicons is used exclusively for the luminance (Y-signal) channel and the other for the chroma (C-signal) channel. Figure 2-1 is a simplified block diagram which shows the basic principle of camera operation.

2-2 OPTICAL ASSEMBLY (BASIC CONCEPTS)

The light which is passed by the zoom lens is split in two directions by a prism. The prism is provided with an input infrared and ultraviolet filter and an output optical low pass filter in the chroma channel. See Figure 2-2.

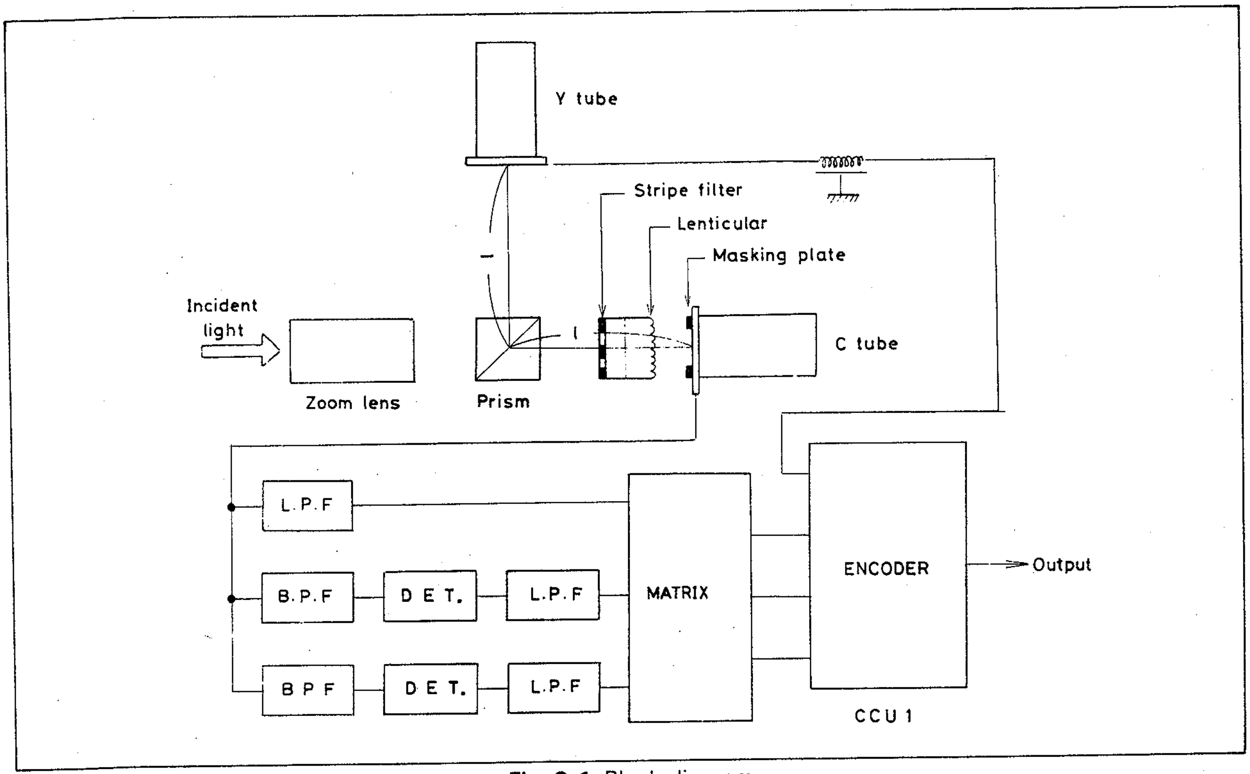
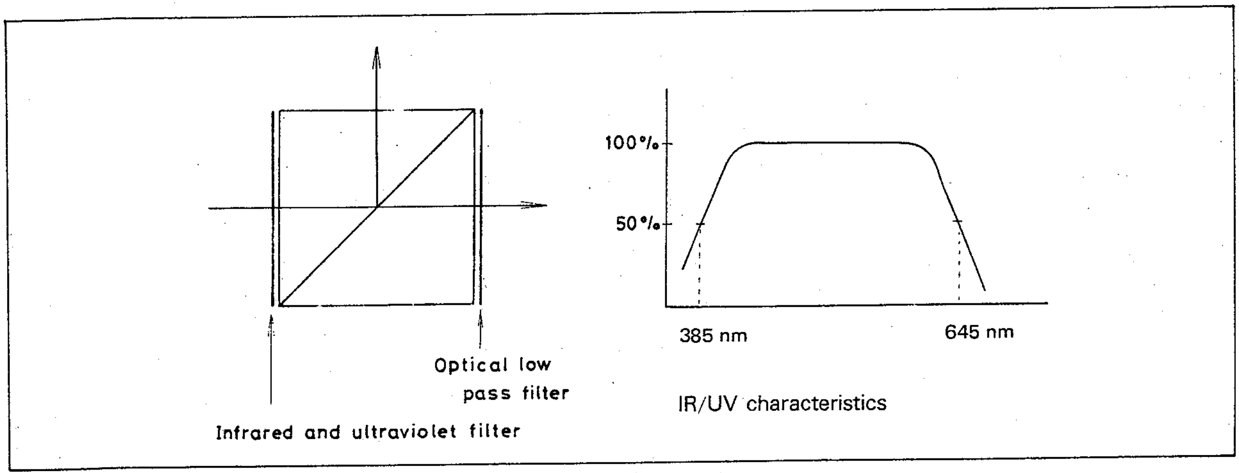

Y tube
Stripe filter
Lenticular
Masking plate
Incident light
Zoom lens
Prism
C tube
L.P.F
B.P.F
D E T.
L.P.F
B P F
D E T.
L.P.F
MATRIX
ENCODER
Output
CCU 1

Fig. 2-1 Block diagram


100%
50%
385 nm
645 nm
Optical low pass filter
Infrared and ultraviolet filter

IR/UV characteristics

Fig. 2-2 Prism

The input filter improves the color reproduction characteristics of the camera while the LPF limits the bandwidth of the chroma signal, eliminating any optical beat. See Figure 2-3.

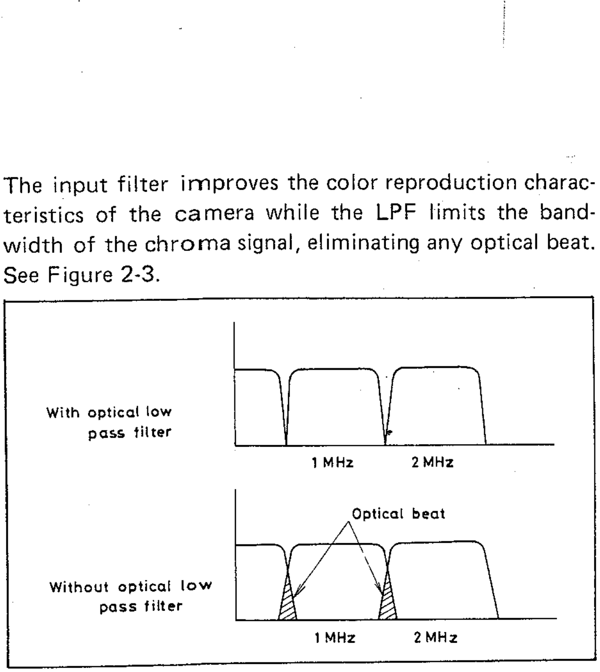


Fig. 2-3

The light which is reflected to the Y vidicon is impressed directly on the target of the vidicon. Essentially, the operation of the Y channel is identical to that of any conventional black and white television camera. Since the luminance signal must be registered with the chrominance signal, a delay line is inserted in the Y channel.

The light which passes through the partially silvered mirror in the prism passes through a stripe filter and a lenticular lens before striking the surface of the chroma vidicon. Construction characteristics of the filter and lens are illustrated in Figures 2-4 and 2-5.

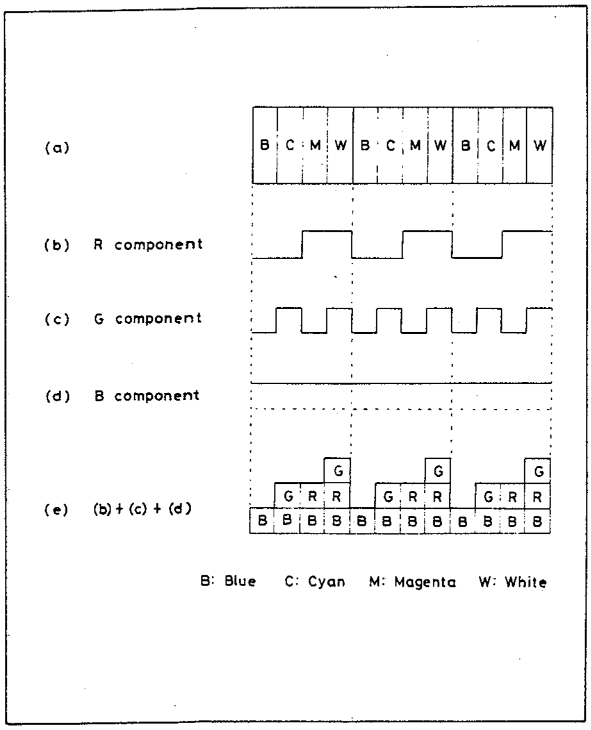


Fig. 2-4 Stripe filter

The lenticular lens elements keep the image in sharp focus on the target, thereby creating the same effect as if the stripe filter were part of the vidicon. The stripe filter consists of 56 groups of stripes, each of which contains blue, cyan, magenta and white stripes. The derivation of the red and green components is illustrated in parts (b) and (c) of Figure 2-4.

To elaborate on the operation of the stripe filter, let us consider a very bright white diamond shaped image landing on the target of the chroma tube. Figure 2-6 demonstrates how the stripe filter separates the signal into red (section b), green (section c) and blue (section d) components. Since the blue component is always present, no modulation is present in that signal.

The modulation subcarriers are generated by scanning the electron beam across the target of the vidicon. It is determined by the width (pitch) of the stripes, the active scan interval and the effective scan area (width) of the vidicon. The frequency may be derived by the formula:

$$F(\mathrm{MHz}) = \frac{W}{PT} \times 10^3$$

where P : pitch is equal to 156.25μ for Red and 78μ for Green

T : the blanking interval of 54.5μ sec.

W : the width of the active scan area: 8.5mm(0.33in)

The output signal of the chroma tube can be considered to be composed of these signals and may be represented by the frequency spectrum shown in Figure 2-7.

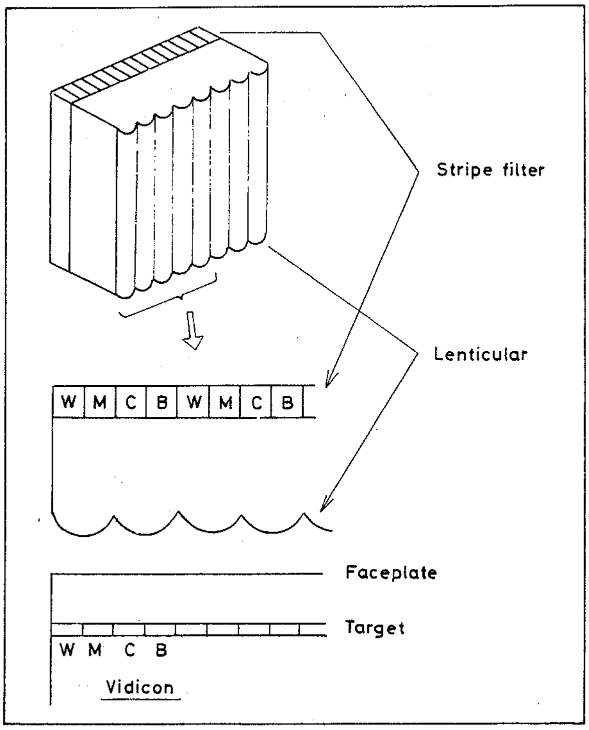
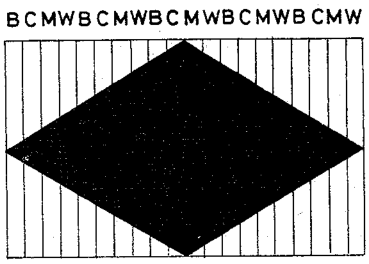
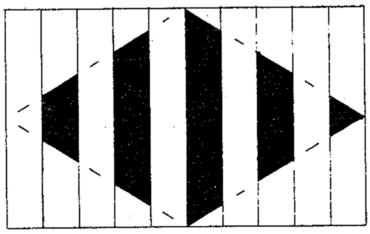


Fig. 2-5 Stripe filter and lenticular

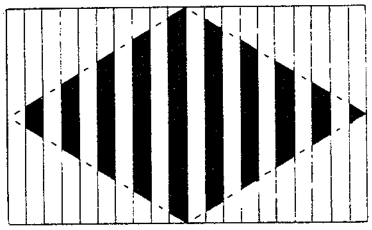
Figure 2-8 shows the output of the preamplifier. This signal is composed of the DC component, the 1MHz component and the 2MHz component.


BCMWBCMWBCMWBCMWBCMW

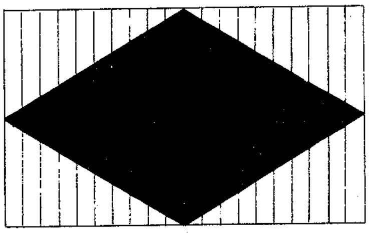
(a) Actual optical image formed on the target by a white diamond shaped subject.



(b) Red component of the signal (1MHz ± 500kHz)



(c) Green component of the signal (2MHz ± 500kHz)



(d) Blue component of the signal (DC to 500kHz)

Fig. 2-6 Operation of the stripe filter

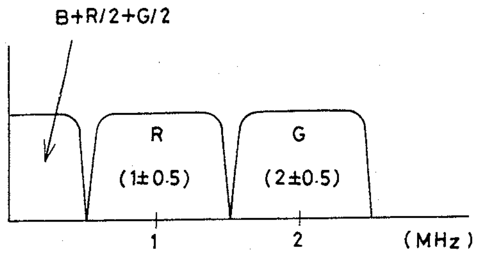


Fig. 2-7 Frequency spectrum

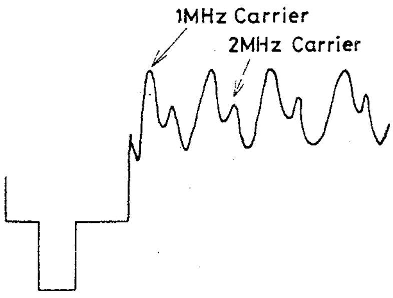

1MHz Carrier
2MHz Carrier

Fig. 2-8 Output of chroma preamplifier

If we expand the chroma signal in a Fourier series:

$$I(t)=B+\tfrac{1}{2}G+\tfrac{1}{2}R-\frac{2}{\pi}R\sin\omega t-\frac{2}{\pi}G\sin2\omega t-\frac{2}{3\pi}R\sin3\omega t\ldots$$

where the blue component is

$B+\tfrac{1}{2}R+\tfrac{1}{2}G$ . . . DC to 500 kHz

$\frac{2}{\pi}R\sin\omega t$ . . . . .A modulated wave

$\frac{2}{\pi}R$ component is 1MHz ±500kHz

$\frac{2}{\pi}G\sin2\omega t$ . . . .A modulated wave

$\frac{2}{\pi}G$ component is 2MHz ±500kHz

Therefore, in the GC-4800U camera, when the objective is separated into three primary colors, the R component is an amplitude modulated signal of 1MHz ±500kHz, the G component 2MHz ±500kHz. This effectively prevents any intermodulation between the signals.

This type of color separation circuit is called a frequency separation system.

The blue signal is now routed through a low pass filter and the red and green signals through band pass filters. The red and green signals are then detected and fed through low pass filters into a matrix where all three signals are proportioned equally. The signals are mixed with the Y signal in an NTSC-type encoder where the output signal is developed.

2-3 BLOCK DIAGRAM

The GC-4800U color camera system is composed of two units, the camera head and the camera control unit. These units are interdependent and neither will function by itself.

NOTE: If an attempt to switch units is made, a complete re-alignment of both units will be required.

The optical image which is passed through the lens is separated into Y and C components by the prism, then converted into video signals by the vidicons.

The luminance (Y) signal is amplified in the Y PRE AMP in the camera head before it is sent to the CCU. It is delayed approximately 1.5 μsec to match phase with the chroma signal. The signal is passed through an AGC circuit to the MIXER/AMPLIFIER where it is combined with the chroma signal. The combined signal is amplified before it is sent to an external unit.

The chrominance (C) signal is amplified in the C PRE AMP before it is routed to the CCU. The composite chroma signal goes to the PRE PROCESS AMP for dark current compensation before it is separated into RED, GREEN and BLUE components by the bandpass and low pass filters. The modulated R and G signals are amplitude detected then passed through low pass filters (500kHz) to the matrix.

The signal which is passed through the LPF is composed

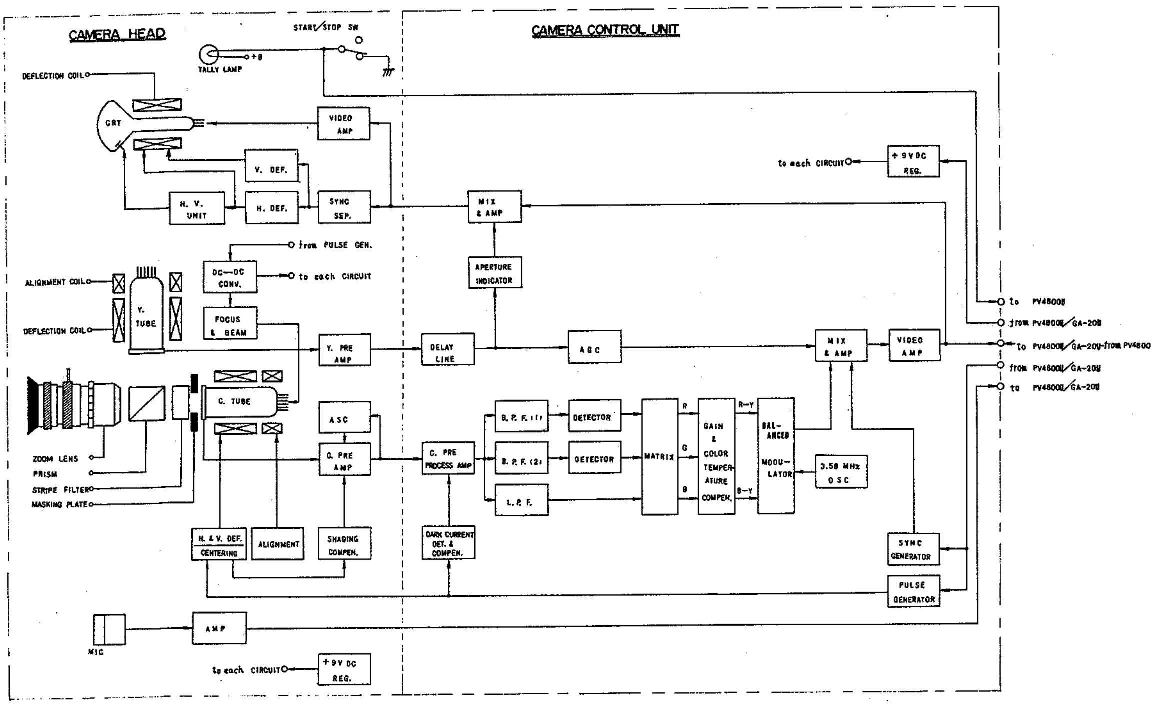

CAMERA HEAD
START/STOP SW
+B
TALLY LAMP
DEFLECTION COIL
CRT
VIDEO AMP
V. DEF.
H. V. UNIT
H. DEF.
SYNC SEP.
from PULSE GEN.
DC—DC CONV.
to each CIRCUIT
ALIGNMENT COIL
Y. TUBE
DEFLECTION COIL
FOCUS & BEAM
Y. PRE AMP
C. TUBE
ASC
C. PRE AMP
ZOOM LENS
PRISM
STRIPE FILTER
MASKING PLATE
H. & V. DEF. CENTERING
ALIGNMENT
SHADING COMPEN.
AMP
MIC
to each CIRCUIT
+9V DC REG.
CAMERA CONTROL UNIT
MIX & AMP
APERTURE INDICATOR
DELAY LINE
AGC
C. PRE PROCESS AMP
DARK CURRENT DET. & COMPEN.
B. P. F. (1)
B. P. F. (2)
L. P. F.
DETECTOR
DETECTOR
MATRIX
R
G
B
GAIN & COLOR TEMPERATURE COMPEN.
R—Y
B—Y
BALANCED MODULATOR
3.58 MHz OSC
MIX & AMP
VIDEO AMP
SYNC GENERATOR
PULSE GENERATOR
to each CIRCUIT
+9VDC REG.
to PV4800U
from PV4800U/GA-20U
to PV4800U/GA-20U·from PV4800
from PV4800U/GA-20U
to PV4800U/GA-20U

Fig. 2-9 Block diagram of the GC-4800U color camera system
(See p.7-1 for larger version of block diagram.)

of B + ½R + ½G. The red and green elements are stripped in the matrix so the output to the COLOR TEMPERATURE COMPENSATOR is only blue. Red and blue balance is obtained in the COLOR TEMP COMP after which the signals are matrixed to R–Y and B–Y. They are modulated by the 3.58MHz subcarrier in the balanced modulator, then routed to the MIXER/ AMPLIFIER where they are combined with the Y and sync signals. The mixed NTSC-type signal is amplified in the VIDEO AMP before it is sent to the external unit.

2-4 DETAILED THEORY OF OPERATION GC-4800U CAMERA HEAD

2-4-1 Optical System

The overall operation of the optical system was discussed in Section 2-2, however a discussion of the black mask and zoom lens is necessary for a thorough understanding of camera operation.

1. Black Mask and Dark Current Detection

   To minimize the effect of dark current variations, a dark current compensation circuit was added to the process amplifier in the CCU. The reference current for this circuit is obtained by placing a mask in front of the bottom six lines of the chroma vidicon. It is necessary to blank at least six lines in order to obtain a valid reference regardless of the F stop used on the lens.

2. Zoom lens

   A lens on which the focal length can be varied while focus is maintained at a fixed point is called a zoom lens. The focal length of the zoom lens supplied with the GC-4800U can be continuously varied from 15mm to 60mm. (4:1 zoom ratio).

   Figure 2-10 is a representation of the basic operation of the zoom lens. Part (a) shows the configuration when the lens is adjusted for a close-up shot.

   At this time the lens has a long focal length. Part (b) shows minimum focal length at which time the image will be wide angle.

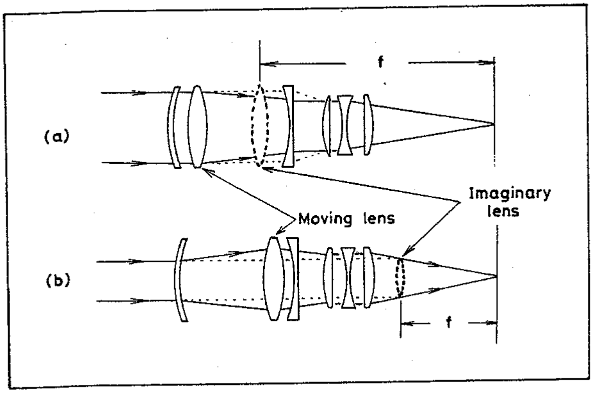


Fig. 2-10 Zoom lens

3. F stop of lens

   The F number represents the amount of light permitted to pass through the lens and is derived from the following equation.

   $F = f/D$

   where: f : focal length of the lens
   D: diameter of the opening(iris) of the lens

   Fundamentally, this means that each time you increase the F stop by one number, (i.e. 2.8 to 4) you have reduced the iris area by one-half and have reduced the light by the same amount.

   There are numerous other factors which will not be interjected in this commentary. Operationally, there is a compromise which must always be made. A low F number permits the greatest amount of light to pass providing the best camera sensitivity, contrast ratio etc., however a higher F number will give you more depth of field. Nominally, the best results can be obtained with an you more depth of field. Nominally, the best results can be obtained with an F stop of 4 → 5.6 with about 300 to 400 ft-candles (3 to 4 thousand lux) incident.

4. Neutral Density (ND) Filters

   These filters change the amount of light transmitted without affecting the color temperature of the light. Three filters are provided with the GC-4800U camera, ND-2, ND-4 and ND-8. The ND-2 reduces the light by one-half, the ND-4 to one-fourth and the ND-8 reduces it to one-eighth. It is recommended that the filter which gives the optimum setting be used when using the camera outdoors.

2-4-2 Electrical System

1. Preamplifiers

   A preamplifier is a circuit which takes the very small signal available at the target of the vidicon and amplifies it sufficiently to make signal processing in the later stages easy. For the purpose of analogy, the vidicon may be considered as a noiseless constant current source (0.1 to $0.3\mu a$). This implies that virtually the entire signal-to-noise ratio of the camera is determined in the preamplifier. Accordingly, the preamplifier must be designed for low noise with sufficiently low input impedance (approximately 150 ohms) to avoid inductive interference from external sources.

2. Luminance Preamp (Y channel)

   Refer to the schematic diagram in Section 7, p.7-6. Since a vidicon is extremely high impedance(several hundred M ohms), a field effect transistor selected for low noise characteristics is employed as the input stage. X101 provides a 3db voltage gain before feeding the signal to X102 and X103. These two stages of amplification supply about 63 db voltage gain moreover, the input impedance is reduced to about 150 ohms by negative feedback from the collector of X103 to the gate of X101. This effectively provides a pure resistive input and minimizes the noise pickup which would be present in a high impedance system.

The input impedance of the preamplifier can be calculated by:

$$Z_i \text{ (input impedance)} = \frac{G_o R_v}{g_m A}$$

where: R_v: the load resistance of the vidicon about 500k ohms

G_o: the load conductance of the FET about 1.5 mmho

g_m: the mutual conductance of the FET about 3 mmho

A : the gain of the negative feedback amp about 1500

X104 and X105 make up a low gain (about 3 db) amplifier with emitter peaking, etc. for good frequency response. X106 is an emitter follower which provides a low impedance drive (75 ohms) to the output.

The Y SET adjustment provides a special feedback pulse to the collector of X105 to cancel the effect of dark current generated in the Y vidicon.

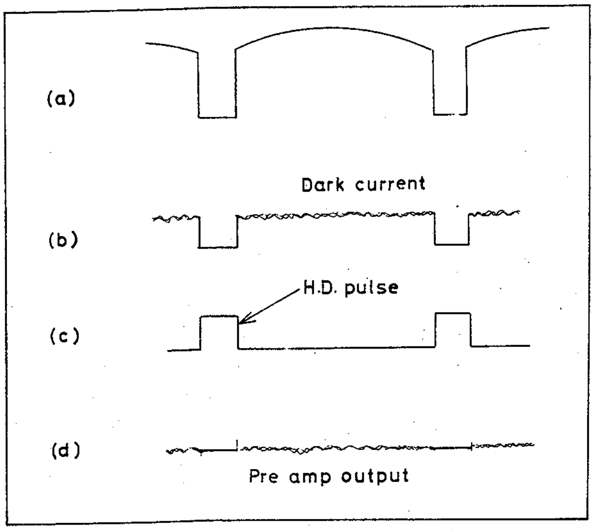


Fig. 2-11 Operation of the Y SET adjustment

Figure 2-11 illustrates the operation of this circuit. Part (a) shows the output of the Y preamplifier when the camera is directed at a white pattern. Ideally, the output should be zero current, as indicated in part (d) when the lens is closed. Dark current will cause a pattern similar to that shown in (b) so an inverted adjustable pulse of the same duration as the blanking pulse is fed into the circuit. Y SET is adjusted until the black level is equal to the blanking level.

3. Chrominance Preamp (C channel)

The basic operation of the chroma preamp is the same as that of the Y preamp. However, it is also necessary to compensate for color shading so both static and dynamic shading is performed in this circuit. Refer to the schematic diagram in Section 7.

A. Static Shading Compensation

The static shading waveform is mixed with the signal at the collector of X205 through R229. Assuming a dark current waveform similar to that in Figure 2-12, part (b), a correction signal (c) is applied to return the dark current waveform to condition (a). This dark current signal will be cancelled in the Dark Current Compensator (DCC) circuit.

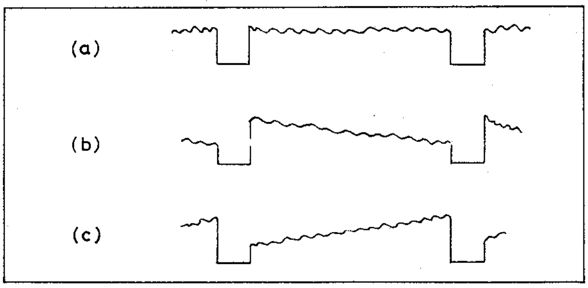


Fig. 2-12 Static shading

B. Dynamic Shading Compensation

The dynamic shading circuit works on the principle of frequency compensation and is effected by emitter peaking on X204 and X205. The source to drain resistance of X207 and X208 is part of the emitter load of X204 and X205. A parabolic and/or sawtooth waveform is applied between the gate and source of the FETs, shaping the gain of the amplifiers for the 1MHz and 2MHz portions of the signal. C213 and R219 form the compensation circuit for 2MHz while R221 and C214 compensate for the 1MHz signal.

For example, consider a parabolic wave applied to the input of the FETs. When the voltage at both ends of the parabola is higher that in the center the source to drain resistance is lower at the extremes and higher in the center. When the resistance of the FET is lowered, this results in less current feedback because of lower emitter resistance. This ability to adjust the gain of the amplifier permits us to shape the output of the preamp for optimum shading.

C. Automatic Saturation Control (ASC)

The signal at the emitter of X206 is coupled across R231 to the ASC circuit. It is rectified by D701 and D702, then charges C703 to a potential proportional to the light striking the target of the chroma vidicon. Any change in this voltage results in a change in conduction of X701, changing the collector voltage which supplies the target voltage for the vidicon. R702 is adjusted to establish a threshold potential at a light level of 1100 lux (102 ft-candles), maintaining constant target voltage from 0 to 1100 lux and thereby preventing high target potential and the resultant high dark current at low light levels.

4. Main Amplifier Circuits

A. Vidicon Horizontal Deflection System

It is always important that the deflection system of a vidicon be linear. This is especially critical in the GC-4800U since poor horizontal linearity will generate color shading problems because of changes in the carrier frequencies. The horizontal deflection system used is relatively conventional but a special linearity compensation circuit has been added.

X301 through X303 are DC coupled stages which are biased off. When a nagative horizontal drive pulse is supplied to the base of X301, all are switched on feeding a negative pulse to the base of X304, the yoke driver.

The voltage pulse developed at the collector of X304 will generate a sawtooth current waveform in the load circuit. The principle of operation of this circuit is virtually identical to that of a conventional television receiver. The path of deflection current is shown by the dotted line in Figure 2-13. The waveforms are shown in Figure 2-14.

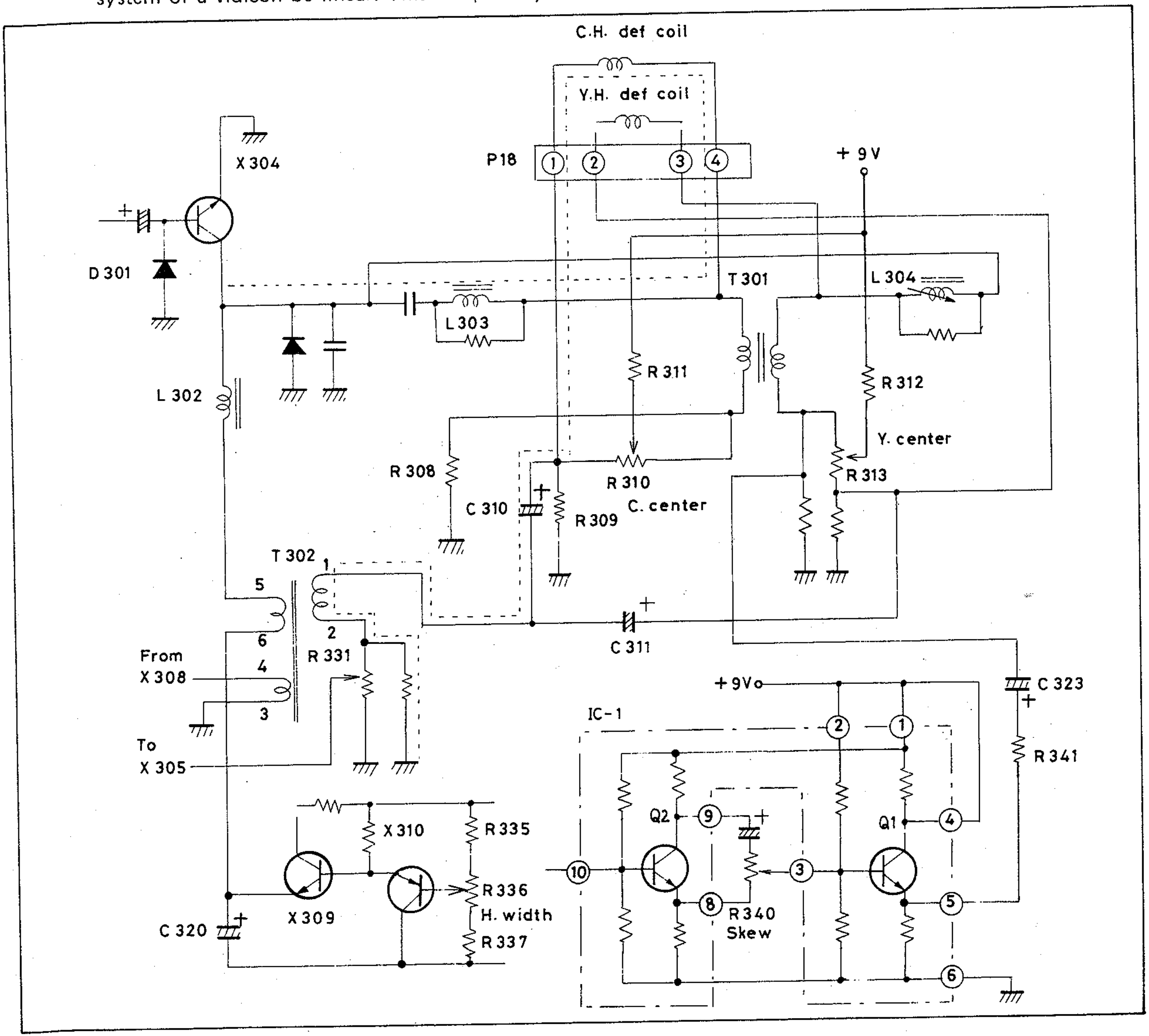

C.H. def coil
Y.H. def coil
X304
P18
1
2
3
4
+9V
D301
T301
L304
L303
L302
R311
R312
Y. center
R308
R310
C. center
R313
C310
R309
T302
1
5
2
6
4
3
From X308
To X305
R331
C311
+9V
C323
R341
IC-1
2
1
Q2
9
Q1
4
10
3
8
5
R340 Skew
6
X310
R335
R336
H. width
R337
X309
C320

Fig. 2-13 Horizontal deflection system

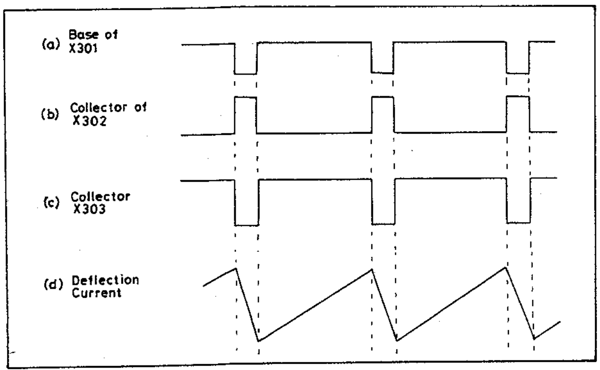


Fig. 2-14 Waveforms of horizontal deflection circuit

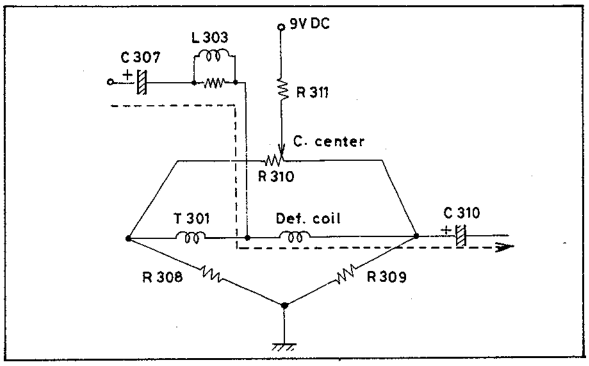


Fig. 2-15 Horizontal centering circuit

D301 is the clamp diode and T301 is an isolation transformer which keeps the deflection current out of the horizontal centering circuit.

Linearity compensation is achieved by tapping off a portion of the deflection current at the wiper of R331 and feeding it to the amplifier composed of X305 through X308. The output of the complementary symmetry driver stage is applied to pin 4 of T302 as degenerative feedback, thereby correcting any variations in the current waveform. This ouput is also sent to X311, a phase splitter which develops the horizontal shading correction waveforms.

B. Vidicon Horizontal Amplitude Circuit

Horizontal amplitude is controlled by changing the voltage supplied to the collector of X304. R336, the HOR WIDTH potentiometer permits us to change the emitter current through X310 and X309, thereby adjusting the collector voltage of X304. An increase in voltage increases the horizontal amplitude.

L304 (Y SUB WIDTH) is a variable inductance which is inserted in the deflection circuit of the Y tube to adjust the horizontal amplitude of that tube without affecting the chroma signal. An increase in inductance reduces the deflection current, decreasing the horizontal amplitude of the Y signal at the vidicon.

NOTE: This results in a wider image at the monitor.

The Y SUB WIDTH adjustment is used to register the luminance and chrominance signals.

C. Horizontal Centering Circuits

In addition to centering the signals on the vidicons, the horizontal centering circuits are used to register the luminance and chrominance signals.

Best performance can be obtained by first centering the chroma signal, then registering the luminance signal with it. Horizontal centering is accomplished by adding a small DC current to the deflection coils.

Figure 2-15 is a simplified drawing of the Horizontal Centering Circuit for the chroma vidicon. The luminance circuit is identical in principle. The dotted line shows the path for deflection current.

The position of the wiper arm of the C Center potentiometer will determine which direction DC current will flow through the deflection coil, thereby controlling the amount and direction of beam offset.

D. Skew Circuit

The skew circuit corrects for vertical angular offset in the Y vidicon. Horizontal angular misregistration is corrected by rotating the deflection coil whereas vertical angular error may be eliminated by adjustment of the skew adjust (R340).

Skew correction is performed by superimposing the vertical sawtooth on the horizontal deflection circuit of the luminance tube. The signal is split by Q2 (The circuit shown in Figure 2-13 is an equivalent of IC-1, the 10HC1 which is used in the circuit.) which develops signals of opposite polarity and equal amplitude. These signals are applied to opposite ends of R340 permitting a correction voltage in either direction. Q1 provides a low impedance drive for mixing the correction signal with the Y Horizontal Centering circuit.

E. Vidicon Vertical Deflection System

The input vertical drive pulse is applied to the base of X315, an emitter follower which couples it to X316, a transistor switch. The switch is closed during the blanking interval providing a quick discharge path for C326 and C327. When X316 is opened at the end of blanking, the capacitors start to charge through R345 at an exponential rate. This charge continues until the succeeding vertical drive signal is applied. This sawtooth signal is emitter

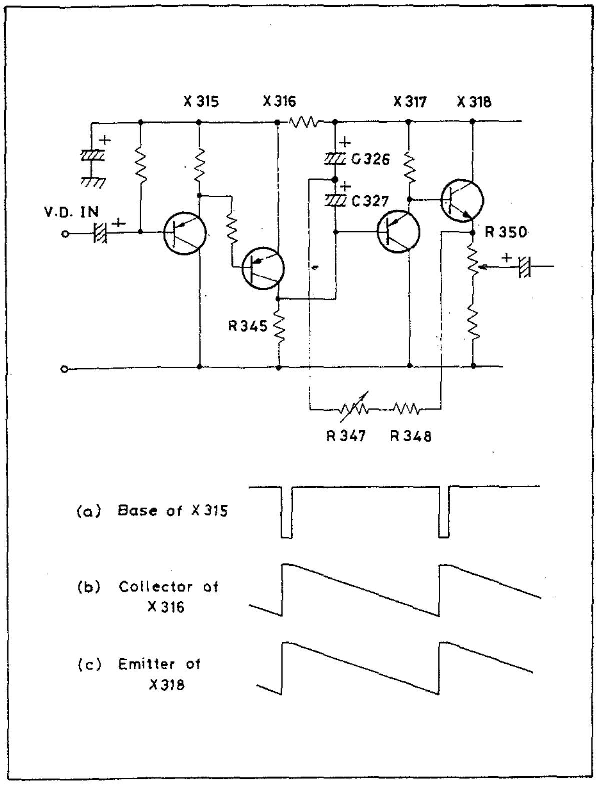


Fig. 2-16 Vidicon vertical deflection system

coupled by X317 and X318 to the deflection output circuit. Feedback from the emitter of X318 across R347 (Vertical Linearity Adjustment) changes the charge rate of the capacitors. The sawtooth signal is tapped off at the wiper of R350 (Vertical Height Adjustment) and amplified by X319. X320 serves as the driver for the output amplifier, X321 and X322 which is connected in complementary symmetry configuration to obtain maximum drive without distortion. Both current and voltage feedback are used to obtain the best possible linearity in the output waveform.

The operation of the vertical centering circuits is virtually identical to that of the horizontal centering circuits, so no explanation of their operation will be made.

F. Alignment Circuits

The basic purpose of the alignment circuit is to center the electron beam emitted by the cathode of the vidicon in the aperture of the acceleration anode (G2) of the vidicon. The alignment coils provide the capability of moving the beam up and down or right and left.

It is imperative that this circuit be adjusted correctly since improper adjustment will affect beam landing focus, especially at the edges of the target area. Poor adjustment will also adversely affect resolution and shading.

Vertical and Horizontal alignment circuits for both luminance and chrominance vidicons are provided.

The basic principle of operation is illustrated in Figure 2-17.

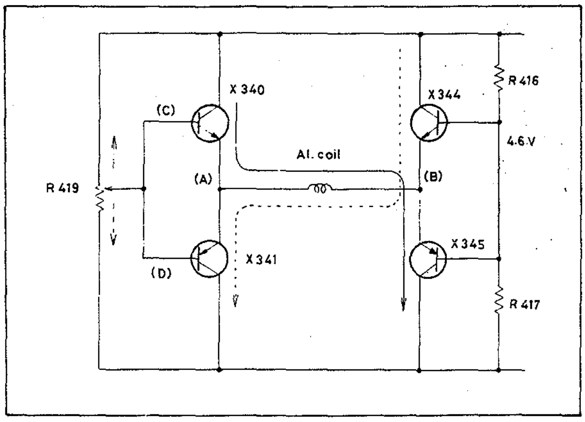


Fig. 2-17 Alignment circuit

The fixed voltage applied to the bases of X344 and X345 maintains a constant 4.6 volts on both transistors. Accordingly, the voltage at Point B must 4 volts or less for X344 to conduct and 5.2 volts or greater for X345 to conduct.

X340 and X341 conduct when the voltage at (c) or (d) is greater than A ±0.6 volts. Current flows in the circuit when both sets of conditions are met. Moving the wiper in one direction causes current to flow through the alignment coil in one direction, moving it in the other direction reverses the current flow.

The DC current flowing in the alignment coil generates a DC magnetic field which operates on the electron beam. The beam is centered in the accelerating anode aperture so that it will always be perpendicular to the target surface, regardless of landing area.

A coil type alignment magnet was selected because it can be easily shielded minimizing the effects of ambient magnetic fields, which would generate shading errors.

G. Automatic Beam Regulator Circuit

The automatic beam regulator circuit is designed to achieve high focussing stability of the vidicon. Basically, a decrease in emission causes the bias to be reduced permitting more beam current to flow.

Figure 2-18 is a simplified version of the circuit. A decrease in emission of the vidicon will cause a decrease in beam current. Since the

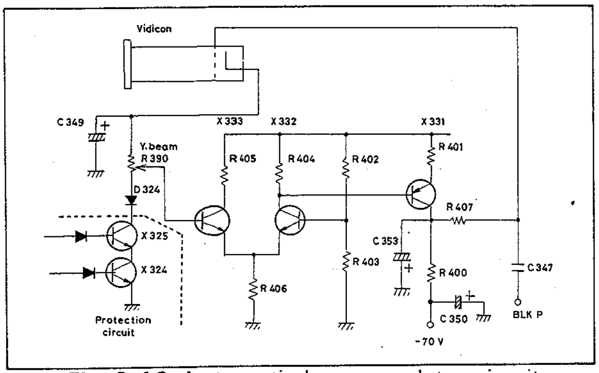

Vidicon
C349
X333
X332
X331
Y.beam
R390
D324
R405
R404
R402
R401
R407
X325
X324
C353
R403
R400
C347
R406
C350
BLK P
Protection circuit
-70 V

Fig. 2-18 Automatic beam regulator circuit

current path for beam current is through the vidicon protection circuit, D324 and R390, a lower voltage will be felt at the base of X333. X333 and X332 make up a differential amplifier with fixed bias on X332. The decrease in current through X333 will lower the emitter voltage increasing the current through X332. This lowers the collector voltage allowing X331 to conduct harder. The more positive (less negative) voltage on the collector of X331 decreases the bias on the vidicon permitting beam current to increase.

H. Vidicon Protection Circuit

The GC-4800U camera is provided with a vidicon protection circuit to prevent damage to the target area in the event of sweep failure. Normally, both the horizontal and vertical deflection circuits develop large voltage pulses during the blanking interval. This voltage is rectified by the voltage doubler consisting of D309 and D310 for the vertical circuit and D311 and D312 for the horizontal circuit. The positive voltages developed forward bias X324 and X325 which are in series with the cathodes of the vidicons. Failure in either sweep circuit will reverse bias the appropriate transistor, killing beam current, thereby preventing damage to the photoelectric surface of the vidicons. See Figure 2-19

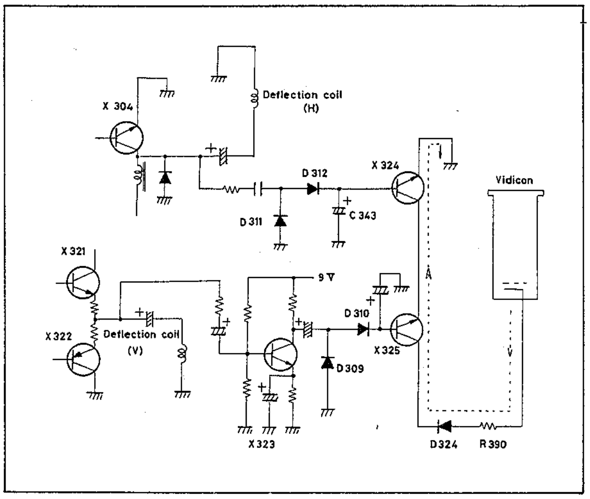

Deflection coil (H)
X 304
D312
X 324
Vidicon
C343
D311
X321
9V
D310
X322
Deflection coil (V)
X325
D309
X323
D324
R390

Fig. 2-19 Vidicon protection circuit

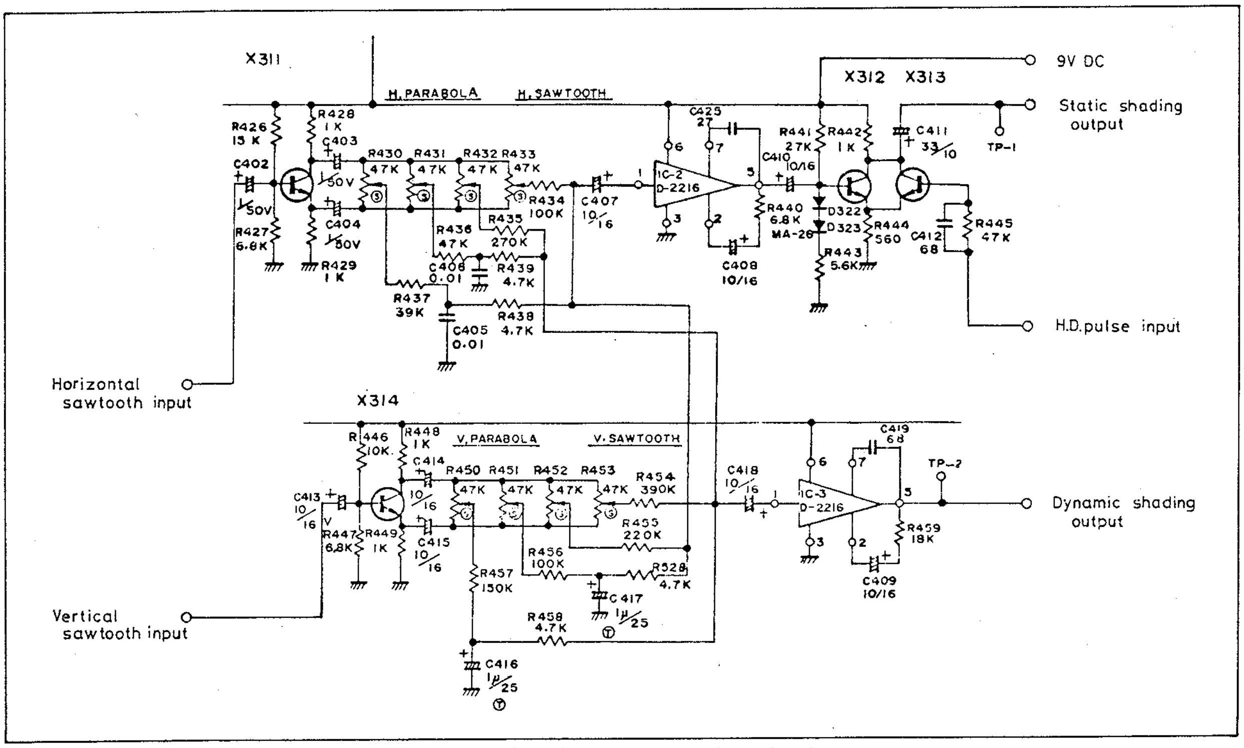

X311
H.PARABOLA
H.SAWTOOTH
X312 X313
9V DC
Static shading output
R426 15 K
R428 1 K
C403
C402 50V
R430 R431 R432 R433
47K 47K 47K 47K
R434 100K
C407 10/16
C425 27
R441 27K
R442 1K
C411 33/10
TP-1
C410 10/16
IC-2 D-2216
R435 270K
R436 47K
C404 50V
R427 6.8K
R429 1K
C406 0.01
R439 4.7K
R437 39K
R438 4.7K
C405 0.01
R440 6.8K
MA-26
D322
D323
R444 560
C412 68
R445 47K
R443 5.6K
C408 10/16
H.D.pulse input
Horizontal sawtooth input
X314
R446 10K
R448 1K
V.PARABOLA
V.SAWTOOTH
C414
R450 R451 R452 R453
47K 47K 47K 47K
R454 390K
C418 10/16
C419 68
TP-2
C413 10/16
R447 6.8K
R449 1K
C415 10/16
R455 220K
R456 100K
R457 150K
R528 4.7K
C417 1/25
IC-3 D-2216
R459 18K
C409 10/16
Dynamic shading output
Vertical sawtooth input
R458 4.7K
C416 1/25

Fig. 2-20 Shading compensation circuit

I. Shading Compensation Waveform Circuit

Both static and dynamic shading waveforms are generated for the horizontal and vertical signals. Since both circuits function in a similar manner, we shall discuss only the horizontal circuit. See Figure 2-20.

A horizontal sawtooth is applied to the base of X311, a phase splitter. The output signals, 180° out of phase with each other, are coupled across C403 and C404 where they are impressed across R430 through R433. The position of the wiper arm on the potentiometers will determine amplitude and phase of the correction signal. The horizontal parabolic correction signals are integrated across R437 and C405 or R436 and C406 before they are combined with the horizontal sawtooth waveforms and the vertical correction waveforms.

The combined static correction waveforms are amplified in IC-2, then mixed with horizontal drive pulses before they are sent to the chroma pre-amplifier.

The dynamic shading signals are amplified by IC-3, then routed to the chroma pre-amp.

J. Vidicon Blanking Circuit

The purpose of the blanking circuit is to cut off beam current in the vidicons during retrace. Vertical and Horizontal drive pulses are mixed across D313 and D314 (See Figure 2-21) then clamped in the base circuit of X327. When X327 is biased off, the collector voltage drops to approximately –70 volts cutting off beam current in the vidicons.

K. Regulated 9 volt supply

From the GA-20U or PV-4800U, 12 volts DC is supplied at pin 10 of the 10-pin connector on the CCU. The 12 volt line is fused in the CCU before it is supplied to the camera head via pin 9 of the 16-pin connector. In the camera head it is tied directly to the emitter of X801, the series regulator. The base of X801 is controlled by IC-5 and the collector provides the regulated 9 volts for distribution to all circuits.

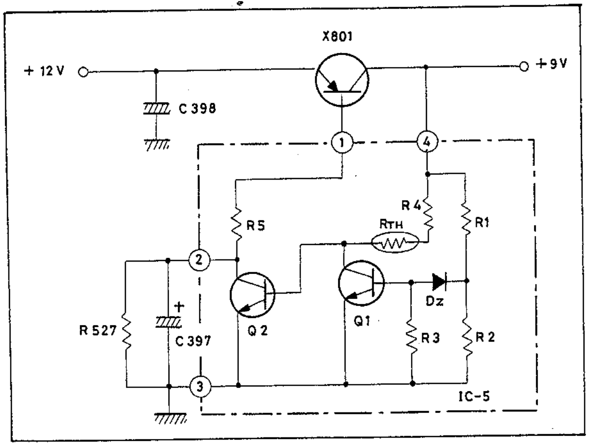


Fig. 2-22

Figure 2-22 shows the equivalent circuit for IC-5. To explain the operation of the circuit, assume a drop in the 9 volt supply. Dz represents a zener diode so the voltage across it will remain constant and the voltage at the base of Q1 will decrease. This causes the base voltage of Q2 to increase lowering the collector voltage. This increases the forward bias on X801 making it conduct harder, increasing the regulated voltage.

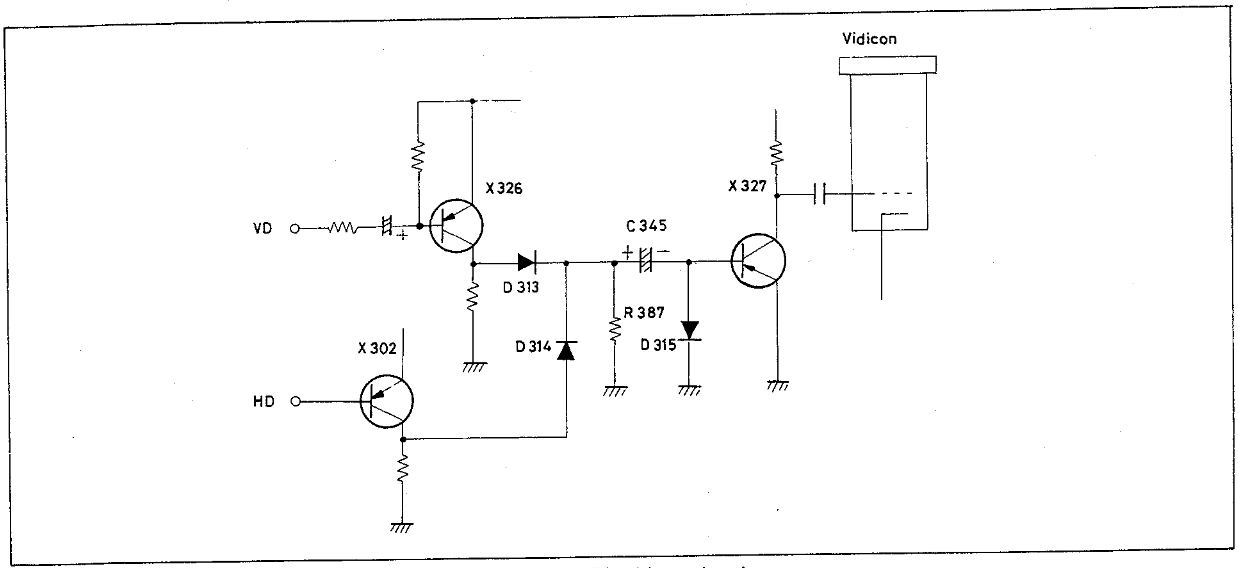


Fig. 2-21 Blanking circuit

2-5 DETAILED THEORY OF OPERATION GC-4800U CAMERA CONTROL UNIT

With reference to the block diagram (Fig. 2-23) the general signal path for the chroma signal may be followed through pre-processing, filtering, AM detection, carrier filtering and matrixing to form B—Y and R—Y orthogonal (quadrature) signals which are ring modulated and mixed to form the chroma signal. The luminance signal is processed and combined to form the final output NTSC-type signal. Though the CCU consists of CCU-1 and CCU-2, initially CCU-2, the signal processing section, will be explained, in accordance with the signal flow. CCU-1, which generates the drives and pulses, will be explained afterwards.

2-5-1 Operation of CCU-2

There are Y and chroma channels, of course, in the signal flow of the CCU-2. Explanation will be done in the order of Y channel, first, and chroma channel, second, utilizing the block diagram, Fig.2-23, and other referenced figures.

1. Delay Line (1.5μsec.)

   The luminance vidicon output is fully amplified at the preamplifier in the camera head, and fed to Y IN (TP-1) of the CCU-2. After that, the phase is delayed 1.5μ sec by the delay line. This delay time is determined by the band width of the chroma channel. The more narrow the bandwidth, the longer the delay time should be. The GC-4800U delay line is almost the same as that of conventional color television receiver (in the case of color television receivers, a delay line of approximately 1μsec. is usually used.), which is that capacitance distributed over a single phase solenoid.

   When the inductance per unit wave length is L, and the capacitance per unit wave length is C, the characteristic impedance is represented as $\sqrt{L/C}$, and in this case, it will be around 600 ohms. R1, R2 and R3 are used for matching of the delay line. Refer to the schematic diagram in Section 7, p.7-10.

2. AGC Circuit (Automatic Gain Control) (Refer to Fig. 2-24.)

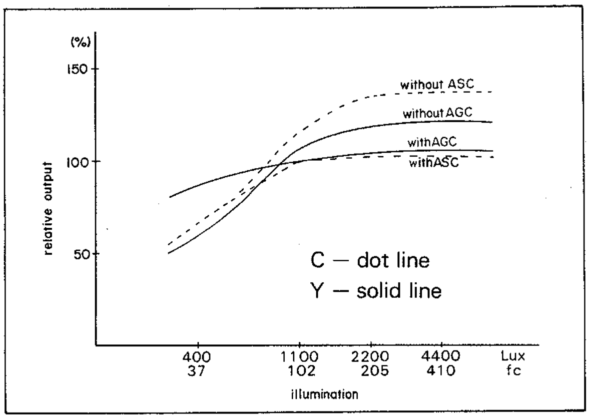


Fig. 2-24

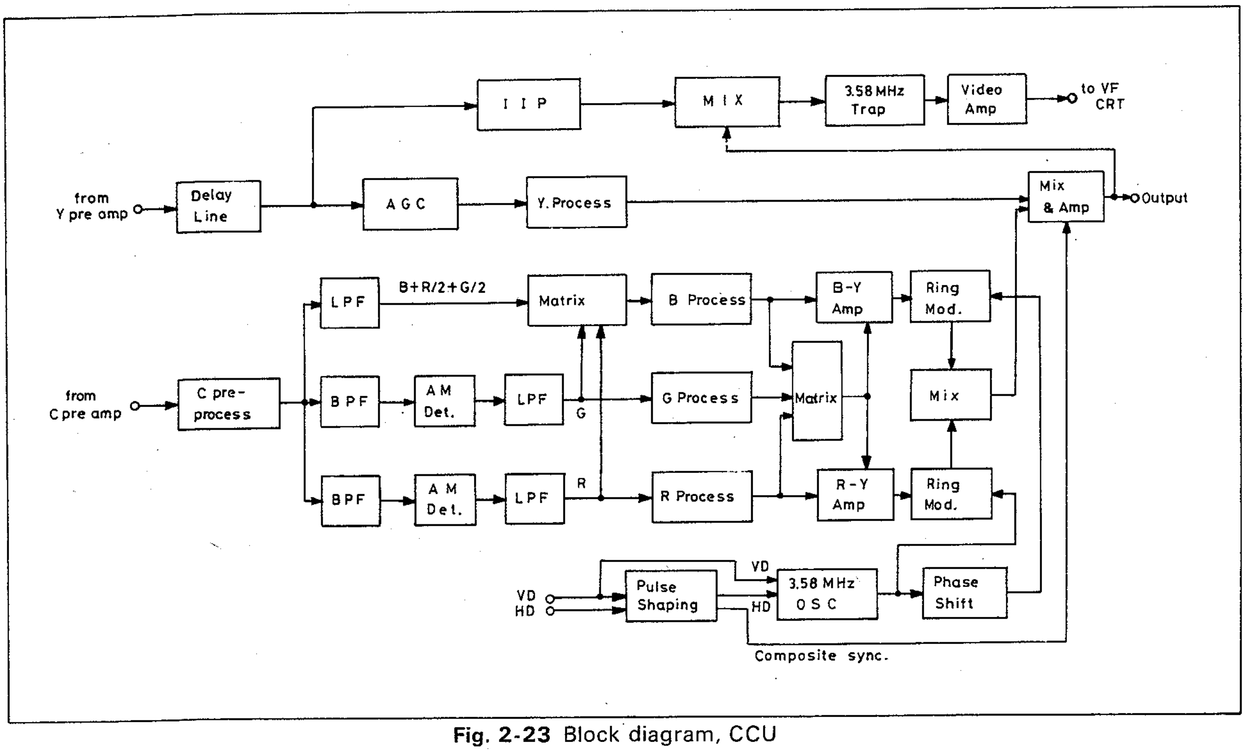

from Y pre amp
Delay Line
I I P
M I X
3.58 MHz Trap
Video Amp
to VF CRT
A G C
Y. Process
Mix & Amp
Output
L P F
B+R/2+G/2
Matrix
B Process
B-Y Amp
Ring Mod.
from C pre amp
C pre-process
B P F
A M Det.
L P F
G
G Process
Matrix
Mix
B P F
A M Det.
L P F
R
R Process
R-Y Amp
Ring Mod.
VD
HD
Pulse Shaping
VD
HD
3.58 MHz O S C
Phase Shift
Composite sync.

Fig. 2-23 Block diagram, CCU

The AGC circuit is the circuit that always keeps its output level constant for the incident light of broad range so that a stable image of high quality can be obtained. In the case of the GC-4800U type, the C-tube is set for 1.8 times reference beam, measured at 100 ft-candles (1,100 lux) with 70% reflectance, and the Y-tube at 4.0 times beam. Consequently the signal from the Y-tube increases to the extent of 410 ft-candles (4,400 lux) without beam shrinkage. But finally, since the video level at VS OUT should be 0.60 volt, its level is controlled in the AGC circuit and the output level is kept constant between 50–410 ft-candles (550–4,400 lux) so that excessive video signal clipping can be prevented. Moreover the C-tube is set at 1.8 times beam, and since the vidicon output is kept nearly constant by the ASC operation up to 410 ft-candles (4,400 lux), it is necessary for the luminance signal to try to make a constant balance with this chroma signal, and it is controlled at a constant level up to 410 ft-candles (4,400 lux).

The principle of operation is explained below. (Refer to Fig. 2-25.)

The signal from the DELAY LINE is amplified at X1, then it is fed to the differential amplifier circuit consisting of X2, X3, and X4. X3 mainly plays a role of temperature compensation. Also, the load impedance of X4 would vary with the AGC voltage applied to the base of X2, therefore, X3, having fixed base bias, changes its emitter current to compensate for variation in X2 emitter current to prevent distortion that otherwise would develop. The output signal is obtained from the collector of X2, and it is fed to terminal 2 of IC-1 (10HC-3), after being amplified, further picked up as the output from terminal 8. On the other hand, the signal for AGC is picked up at terminal 6 and amplified at IC-2 (10HC-1). (Chain line bounds the internal circuit of 10HC-1). D1 and D2 are components for the voltage doubler rectifying circuit of video signal, and they produce DC voltage proportional to the magnitude of the video signal. X6 is the emitter follower for the buffer. The base voltage is picked up from the emitter and fed to the base of X2.

Next in order to understand the principle of operation, let us consider the case that intensity of illumination of subject becomes higher and a larger video signal is produced. When the video signal becomes larger, then as a matter of course, the DC voltage produced by D1 and D2 rectifiers becomes larger with the result that the base voltage of X6 drops. Accordingly the emitter current of X6 increases and the emitter voltage drops. Since this voltage is applied to the base of X2, the collector current of X2 decreases, and the output decreases. R15 (Y GAIN) determines the operating level of the AGC circuit. Assuming that this potentiometer is set at its ground side position, the collector voltage of X5 goes up, consequently the base and emitter voltages of X6 rise. Since this voltage is applied to the base of X2, the gain of X2 increases and the output level goes up. That is, the gain of AGC circuit can be adjusted by this potentiometer.

3. Process Amplifier
   a. Operation of process amplifier

      The process amplifier is a circuit that shapes the video signal from the vidicon into the signal specified and its operations are as follows:

      (1) Clamping of the blanking portion of input signal and determination of the black level. (Set-up level setting)

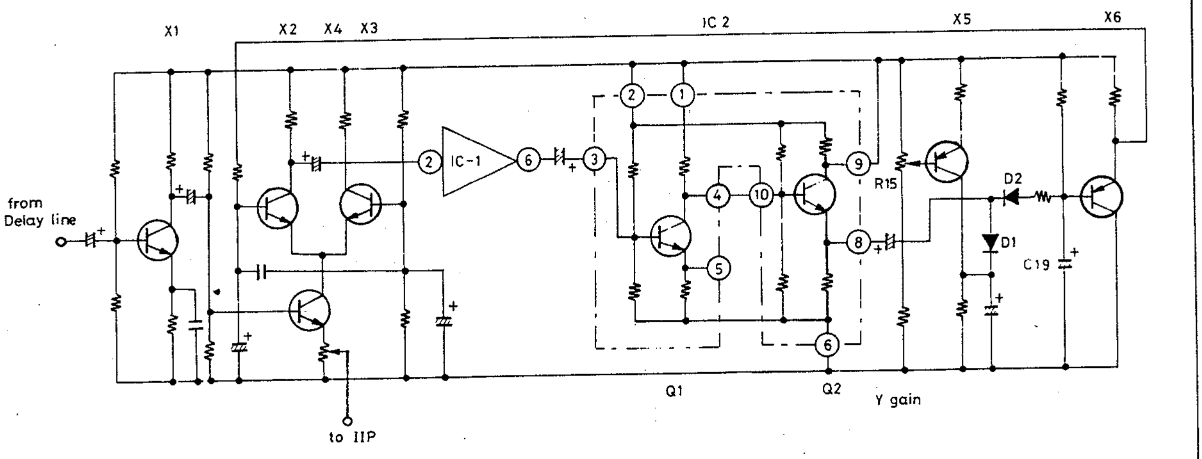


Fig. 2-25 AGC circuit

(2) Obtaining the blanking interval specified by the blanking pulse insertion to input signal. (Blanking mixer)

(3) Obtaining image easy to see by regulating the white peak of video signal. (White peak clip)

(4) Elimination of the noise component and slope within the blanking interval. (Linear clip)

(5) Input signal amplification

In the case of the GC-4800U, this process amplifier consists of two IC's (IC1, IC3) and four transistors. Though IC1 is described as Clamp Circuit and IC3 as Process Circuit in the block diagram, both circuits, in general, are called the process amplifier includes four circuits; the Y signal shaping circuit (IC-1, IC-3), and the primary color, blue, red, and green, shaping circuits. (Consisting of IC-4, IC-5, IC-8, IC-9, IC-6 and IC-7), but the operation for those circuits are all the same. Then the operation of only the Y process amplifier will be discussed.

However, the transistor circuit consisting of X8 through X11 is provided as an only circuit for the process amplifier and therefore used in common for all the IC's. The video signal shaped by the Y process amplifier is mixed with the carrier color signal in the X31 (MIX) or CCU-1 after through the emitter follower circuit X7, and put into output as VS OUT.

b. Principle of operation of the process amplifier (Refer to Figs. 2-26 and 2-27.)

Since Q1 is the emitter follower circuit, then the waveforms at the base and emitter of Q1 and the base of Q3 are almost the same. This waveform, as shown in Fig. 2-27(a), is of positive polarity. Q2 is

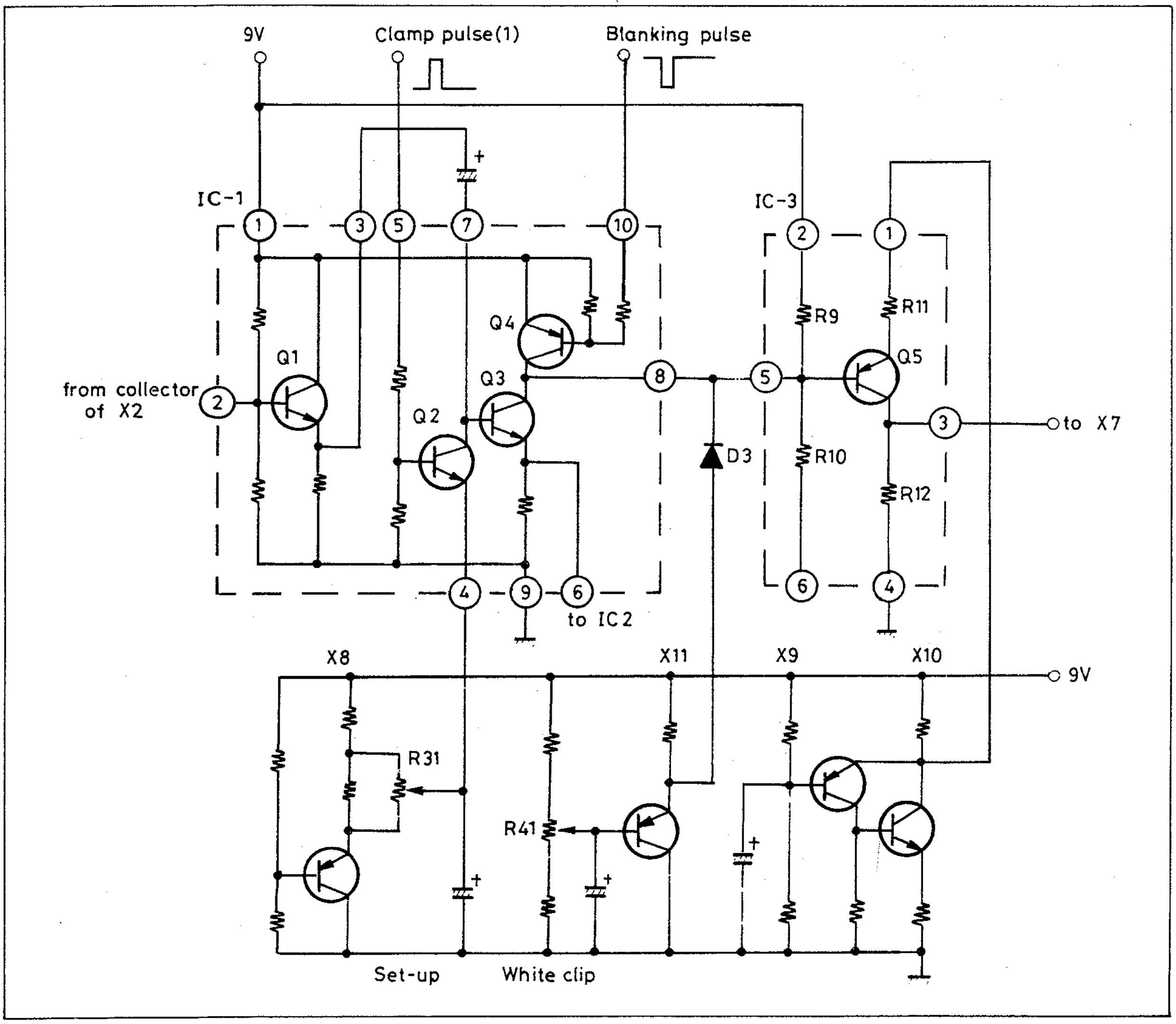


Fig. 2-26 Process amplifier circuit

the clamper. When a positive clamp pulse is fed, it turns on and it is kept in off condition in other cases. Thus clamping operation can be performed. (Refer to Fig. 2-27(c).) That is, the signals at all the blanking interval is clamped and they are kept in a constant level. This signal, when no blanking signal exists and Q4 is turned off, is amplified by the class -A amplifier Q3 with R9 as load, its waveform is theoretically as shown in Fig. 2-27(d). But actually, since Q4 turns on and off by the blanking pulse, Q3 operates as a class-A amplifier only when no blanking pulse exists. When Q4 turns on, the amplification function of Q3 is lost, and the collector voltage of Q3 is kept at B+, i.e., 9 volts. That is the waveform becomes as shown in Fig. 2-27(f). On the other hand, X9 and X10 constitute a constant voltage circuit, and the emitter voltage of Q5 is kept constant. For this reason, Q5 operates only when its base voltage drops by 0.6 volt or more relative to the emitter voltage of Q5. Q5 is cut off and clipped when the voltage difference becomes less than that value. Further, this clip level is always constant and determines the final blanking width and pedestal level. The dotted line shown in the figure shows the case that the clamp voltage is raised up by the set-up potentiometer R31, but as shown in Fig. 2-27(f), it is observed that the black reference signal is far distant from the clip level (pedestal level). The difference of level between this pedestal level and the black reference signal is called the set-up level. For the GC-4800U type, the set-up level is adjusted so that it can be 0.1 volt at VS OUT. Next D3 is a diode for the white clip use. In the case that the collector voltage of Q3 drops to the emitter voltage of X11 (in the case of white clip), the diode turns on thereby causing the clip operation. This clip level is adjusted by the white clip potentiometer, R41.

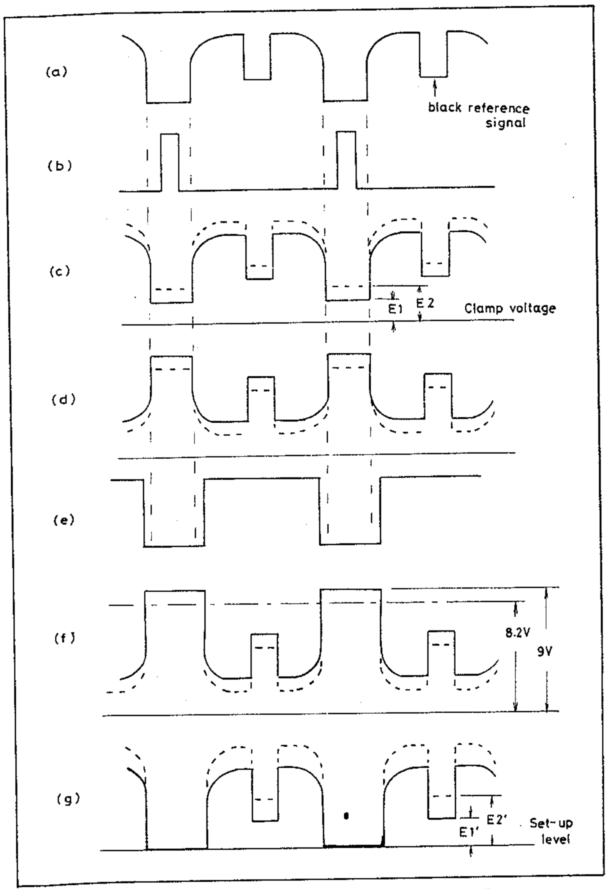


Fig. 2-27 Process waveforms*

(a) Waveform at the base of Q3 before being clamped
(b) Clamp pulse (base of Q2)
(c) Waveform at the base of Q3 being clamped.
(d) Waveform of the collector of Q3, when Q4 is turned off.
(e) Blanking pulse (base of Q4)
(f) Waveform at the base of Q5
Clip level — finally it is regarded as the pedestal level.
(g) Output waveform of Q5

4. Chroma Pre-process Circuit

a. Description

The chroma signal is compensated at the C preamplifier for both the static and the dynamic shading, and fed to the CHROMA IN (TP-3) in the CCU-2 printed circuit board. In the chroma preprocess circuit, there is a dark current compensation circuit that automatically compensates for the increase of dark current and the set-up zero adjustment circuit (pre set-up) that is performed in the Y preamplifier. The increase of dark current causes the set-up level to change resulting in change of reference black level. Further since the blue signal component obtained by the vidicon ranges from DC to 500kHz in the case of the GC-4800U, the effect of dark current increase becomes eminent and it causes the increase of blue component resulting that the image all over the picture is tinged with blue. The chroma pre-process circuit performs dark current compensation and pre set-up adjustment as mentioned above.

b. DCC circuit (Dark Current Compensator)

The color signal from the C preamplifier is fed to

---

*For the case of using Set-up window pattern SPS-4800U, Chart No.3, with APL 90%, as the subject. (The dotted line shows the result when the clamp voltage is raised up by the set-up potentiometer, R31, from E1 to E2.)

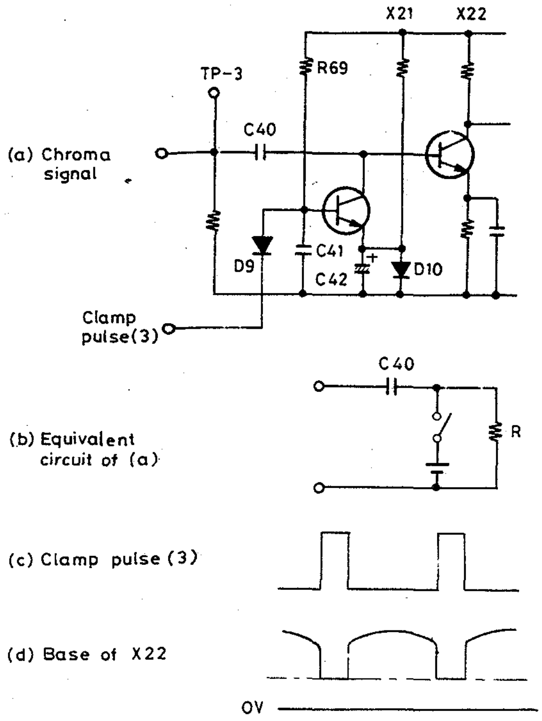

X21
X22
TP-3
R69
C40
(a) Chroma signal
C41
C42
D9
D10
Clamp pulse(3)
C40
R
(b) Equivalent circuit of (a)
(c) Clamp pulse (3)
(d) Base of X22
0V

Fig. 2-28 Clamp circuit

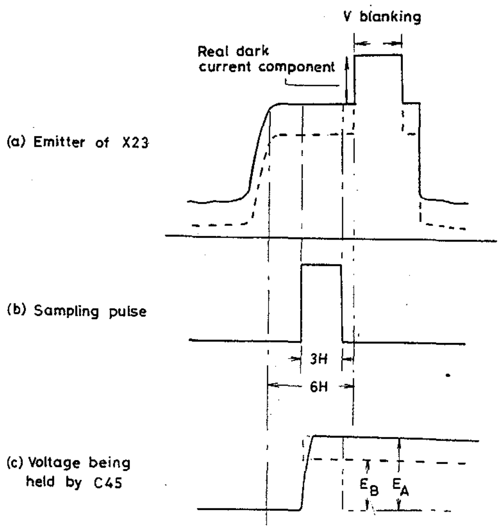

V blanking
Real dark current component
(a) Emitter of X23
(b) Sampling pulse
3H
6H
(c) Voltage being held by C45
E_B
E_A

Fig. 2-30 Waveform of sampling gate

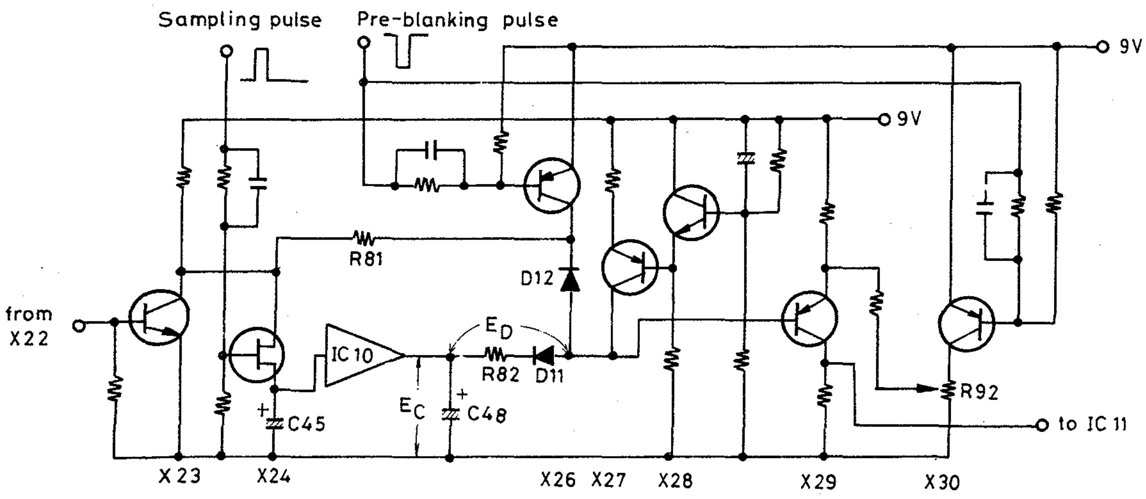

Sampling pulse
Pre-blanking pulse
9V
9V
R81
D12
from X22
IC 10
E_D
R82
D11
E_C
C48
C45
R92
to IC 11
X23
X24
X26
X27
X28
X29
X30

Fig. 2-29 Dark current compensator

TP-3. X21 clamps during the blanking interval for the input signal and makes it constant in level. X21 is turned off when no pulse is fed, since its base voltage is kept near 0.6 volt because of the turning on of D9. However, when a positive pulse is applied, D9 turns off and higher base voltage is applied through R69 resulting in turning on X21, thereby causing the clamping operation. (Refer to Fig. 2-28.)

Next the signal of which blanking interval is clamped is amplified at X22, and receives buffer action at X23. X24 is the sampling gate employing a FET which gates the dark current at the 3H period prior to the V blanking interval (the output of vidicon current in the portion where incident light is completely interrupted by the black mask), and holds the voltage at C45. (About 1V interval, refer to Fig. 2-30.) And this holding voltage is picked up at C48 as a tightly regulated voltage with magnitude almost the same as at C45, because IC-10 is a source follower that operates as a constant voltage power supply with high input impedance and low output impedance. Consequently this voltage is inversely proportional to the dark current, and when the dark current increases the voltage becomes smaller; further when dark current decreases it becomes larger.

On the other hand, a DC-coupled amplifier composed of X27 and X28 is a constant current source. During the blanking interval, pre-blanking pulse is applied to the base of X26, and X26 turns on. In this case, 9 volts voltage is fed to the cathode side of D12 thereby causing D12 to be cut off. Accordingly the output signal from X23 is not applied to the base of X29. When D12 is cut off, constant current flows through in the order of D11, R82, and C48. Accordingly the voltage difference across D11 and R82 is constant within the blanking interval. At the interval for video signal, X26 is cut off. Since its collector voltage is low, D12 turns on and the output signal from X23 is applied to the base of X29 through D12; D11 turns off and the voltage held at C48 is not brought into output.

Let us consider the case that the dark current increases by referring to the Fig. 2-31. The figure (a) shows the emitter waveform of X23, and when the dark current increases, the waveform slides up to the video signal waveform, then the waveform goes down as shown in the figure. That means that the set-up level becomes larger by the amount of dark current increase. Since D12 turns off within the blanking interval, the input voltage for X29 is the resultant of the voltage E_C at C48 and the voltage E_D across R82 and D11. If this composite voltage (pedestal level) is gone down by the amount of the voltage (ΔDC) that is down due to the increase of dark current, it reaches substantially the same result as obtaining the set-up level required, and the increased amount of dark current can be cancelled. To perform this, since the E_D is constant, it means that the E_C is gone down by ΔDC. Look again at the sampling gate waveform in Fig. 2-30. When dark current increases, though the blanking chip is clamped and does not change, the dark current detection voltage becomes smaller as shown in the figure, and the voltage picked up by the sampling also becomes smaller. When this voltage ($E_A - E_B$) is ΔDC, then the set-up level is always kept constant and apparently the dark current is completely cancelled. (Refer to Fig. 2-31(d).) X30 plays the role of an inverter. A pre-blanking pulse is applied to the base, and an inverted positive pulse is received from the collector. This pulse is applied to the emitter of X29 and mixed with the base waveform. In this case, when the magnitude of the pre-blanking pulse is properly adjusted by means of the pre set-up potentiometer, R92, as shown in Fig. 2-31(f), the blanking level and the dark current level can be made equal so that set-up zero adjustment can be performed. DCC operates, as mentioned above, that after once the zero adjustment is performed, when the dark current changes, the variance is cancelled. It does not mean that the dark current can from the first be cancelled.

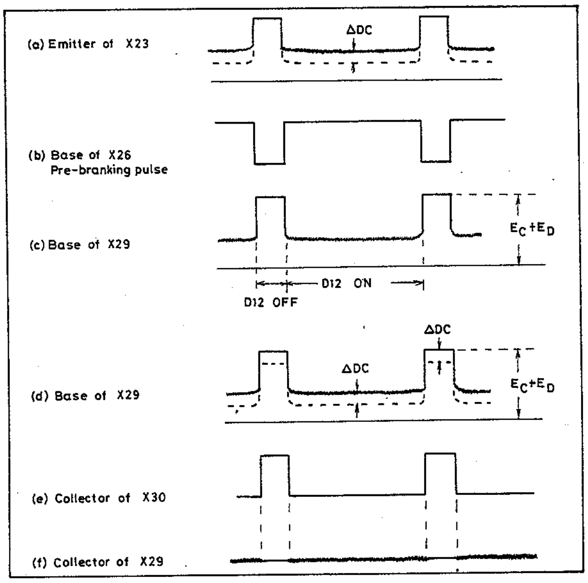


Fig. 2-31 DCC circuit waveform

5. Amplification Circuit IC-11 (BA-308) (Refer to Fig. 2-32.)

   The pre-process amplifier output, after amplified at IC-11, is fed to an emitter follower circuit consisting of X31 and X33, and separated into the

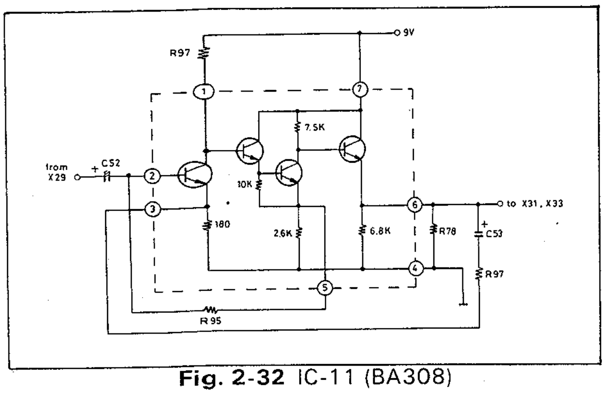


Fig. 2-32 IC-11 (BA308)

three primary color signals at the outputs of a LPF and two BPF's.

6. Blanking Noise Reduction Circuit

a. Principle

Each AM modulated wave is picked up by means of the band pass filter, but the noise component within the blanking interval becomes larger by these BPF. This noise component within the blanking interval may cause interference with the normal clamping operation at the process amplifier after detection, and noise in the form of lines may appear on the picture. The blanking noise reduction circuit eliminates the noise within the blanking interval. See Fig. 2-34.

b. Operation (Refer to Fig. 2-33.)

The chain line shows a part of IC-13 (BA-308). The signal after through BPF is amplified utilizing R130 as the load resistor. Though X38 and X39 turn off at the normal condition, when negative blanking pulse is applied to the emitter of X39, X39 turns on at the condition that the base voltage is 0 volt and the emitter is negative. Since the collector current of X39 causes a big voltage difference to R135, then X38 turns on. Since turning X39 on means that the load resistor R130 of Q1 is shorted from the alternating current standpoint, the AC component is by-passed directly to the power supply within the blanking interval, and no output is produced. (Refer to Fig. 2-34.)

7. Chroma Detection Circuit

a. Principle

The three primary color signals, red(R), green(G), and blue(B), obtained from the chroma vidicon, in the case of the GC-4800U, are modulated in their amplitude, except the B signal; the modulation frequency is 1MHz for the R signal and 2MHz for the G signal. Accordingly in order to separate the original R and G primary color signals, these modulated waves have to be detected. That is the reason why a chroma detection circuit is required.

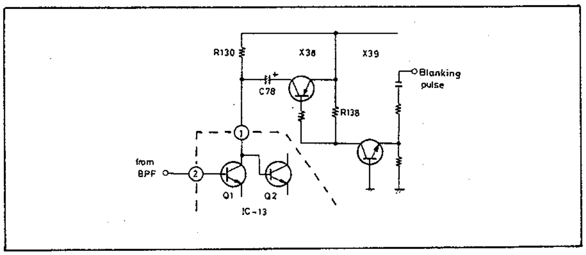


Fig. 2-33 Blanking noise reduction circuit

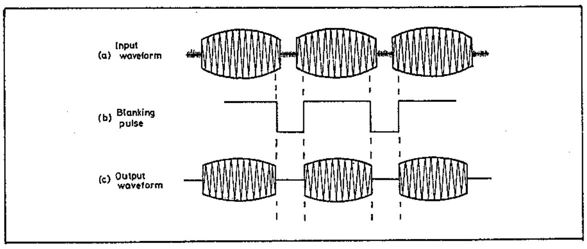


Fig. 2-34 Blanking noise reduction waveform

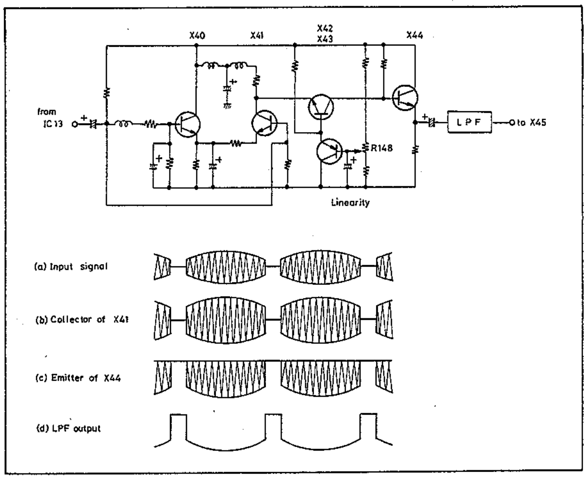


Fig. 2-35 G signal detection

b. Operation

oGreen signal detection, referring to Fig.2-35, uses a 2MHz, half-wave rectification circuit. After band-pass filtering and then clamping by the blanking noise reduction circuit previously described, the signal enters the detection circuit, which consists of X40, X41, X42, X43, and X44 along with the associated passive components. X41 is a class-A amplifier with linear characteristic and temperature compensation from X40. The input signal is shown as waveform (a) of the figure and the output as waveform (b). X42 acts as a detector with X43 supplying temperature compensation. Control of the threshold for the detection is provided by potentiometer R148. The signal at the emitter of X44 is shown by waveform (c). A low pass filter (LPF) network following X44 removes the residual carrier with the resulting output of waveform (d).

oThe red signal 1MHz detection circuit is theoretically the same as the green signal detection circuit, but the detection circuit for the R signal consists of a full-wave rectification circuit. (See Fig. 2-36.) The reason is that since the 1MHz carrier is low enough to be close to the maximum frequency of the demodulated red signal, the carrier frequency is doubled (2MHz) by full-wave rectification so that the carrier is better rejected at the LPF. (Refer to Fig. 2-37.) IC-15 is a phase inversion amplifier and R169 is the carrier balance potentiometer; and the level fed to the IC-15 is adjusted so that in the case of the full-wave detection the magnitude of carrier can completely be made equal. Fig. 2-36 shows the extended carrier so that principle of the full-wave rectification type detection can easily be understood.

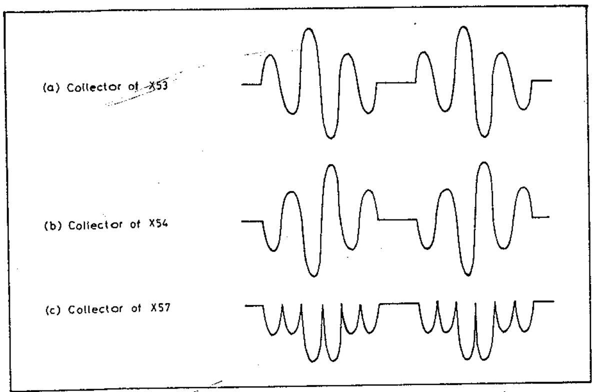


Fig. 2-36 Principle of the full-wave rectification type detection

oThe blue signal does not require detection since blue is a component of each stripe of the chroma vidicon filter and therefore appears as a base-band signal. The circuit, consisting of X31, X32, low-pass filter and resistance matrix (R110—R114), removes red and green signal components from the chroma signal, resulting in the blue signal.

8. Color Temperature Compensation Circuit
   a. Principle

The color temperature compensation circuit operates that when the color temperature of luminous source varies, the gain of amplifier for the R and the B channel is controlled so that R = G = B can be obtained, and a switch must be set so that correct color reproducibility can be performed. In the case of the GC-4800U, 3200°K (3000°K to 3450°K, indoor), 5100°K (4500°K to 5800°K, morning & evening), 6500°K (5800°K to 8000°K, outdoor) a three step change over should be performed depending on lighting conditions.

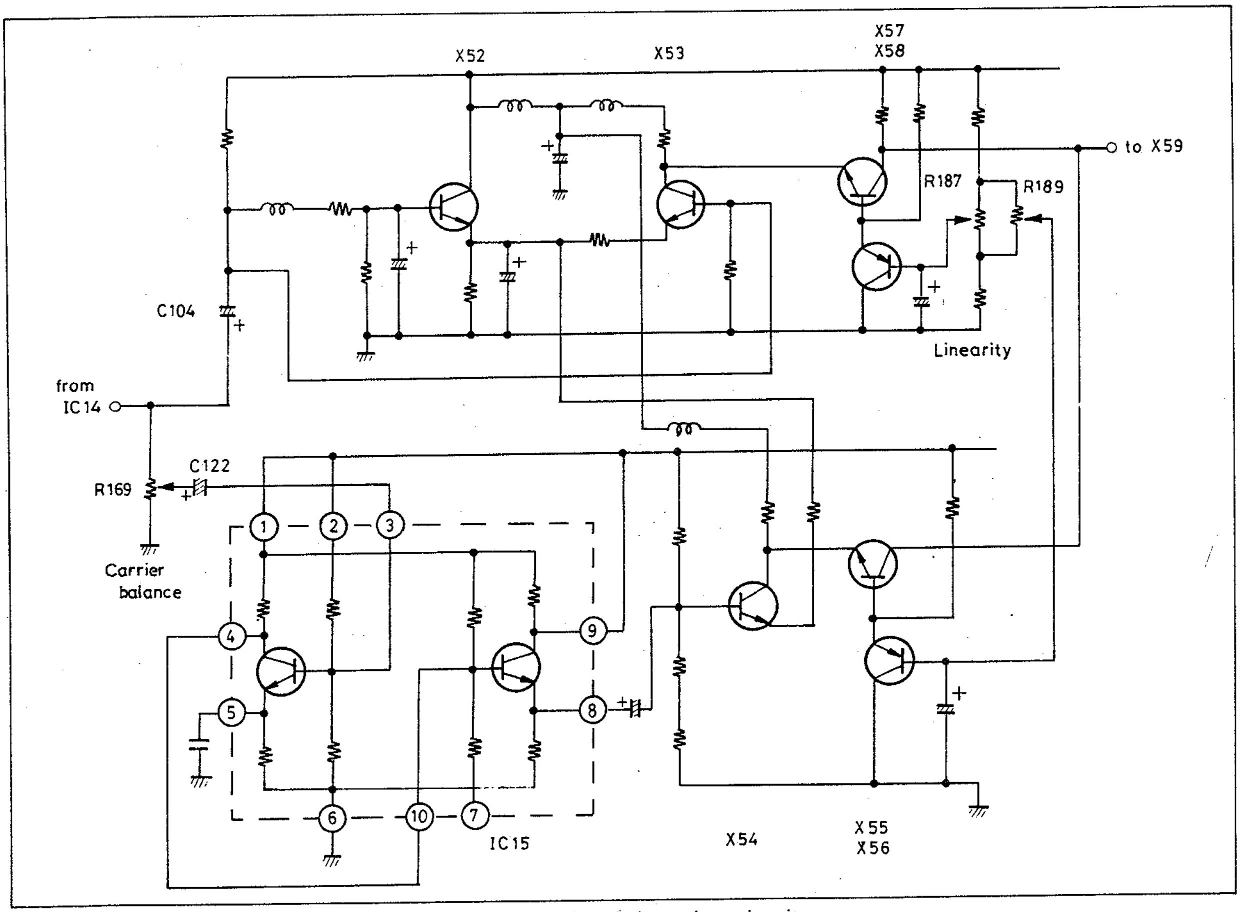


Fig. 2-37 R signal detection circuit

b. R channel gain control (Refer to Fig. 2-38.)
X61 is a current negative feedback type amplifier. The amplification factor (gain) of this amplifier, Av, is approximately determined by the relationship $A_v = R_L/R_E$. Accordingly the gain is controlled by changing the emitter resistance. When the input voltage is indicated as e_i and the voltage developed at the emitter is indicated as e_E, as shown in the figure, (no by-pass capacitor exists in the emitter circuit, and C120 is conductive from the AC standpoint), the base-to-emitter voltage of X61 is actually e_i-e_E, and negative feedback is performed. The voltage developed at the emitter is equal to $i_E \times R_E$, and the larger the R_E becomes, the more the negative feedback quantity increases resulting in gain decrease. C120 rejects the DC component so that when the color temperature steps are changed over, the bias voltage will not be changed.

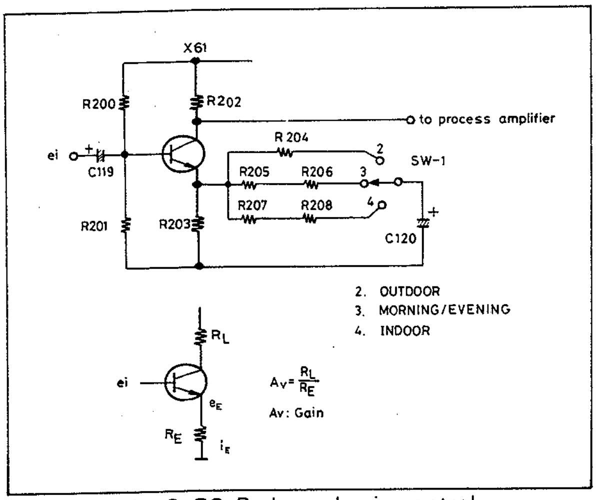

X61
R200
R202
to process amplifier
R 204
2
SW-1
ei
C119
R205
R206
3
R207
R208
4
R201
R203
C120
2. OUTDOOR
3. MORNING/EVENING
4. INDOOR
RL
ei
eE
RE
iE
Av= RL/RE
Av: Gain

Fig. 2-38 R channel gain control

c. B channel gain control (Refer to Fig. 2-39.)
The B channel control is performed at IC-12. The diagram shows the interior of IC. Q1 is the emitter follower that sends out a signal with low output impedance. Q2 is an emitter-input type amplifier. The gain control is performed, as shown in the Fig. 2-39, by changing the coupling resistors. Gain is proportional to the value of R1 compared to the coupling resistors; therefore the smaller the coupling resistor becomes, the more the gain increases. C66 is a capacitor that rejects the DC component.

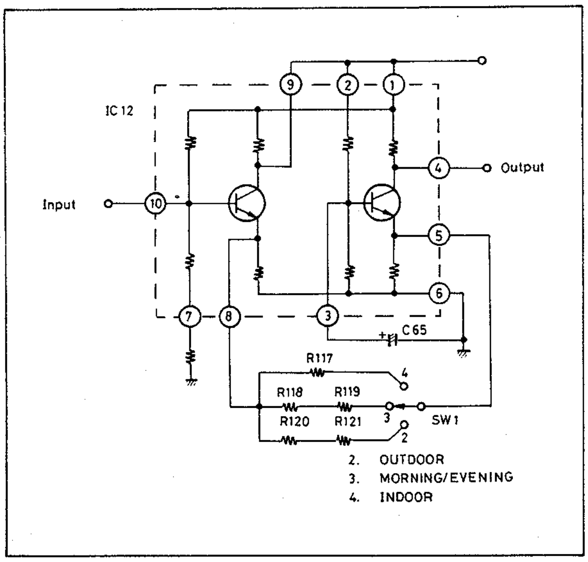

IC 12
9
2
1
4
Output
Input
10
5
6
7
8
3
C65
R117
4
R118
R119
R120
R121
3
SW1
2
2. OUTDOOR
3. MORNING/EVENING
4. INDOOR

Fig. 2-39 B channel gain control

9. IIP (Iris Indicator Pulse) Generator Circuit (Refer to Fig. 2-40.)
X12 and X13 amplify the luminance signal, and D7 and D8 perform voltage doubler rectification.

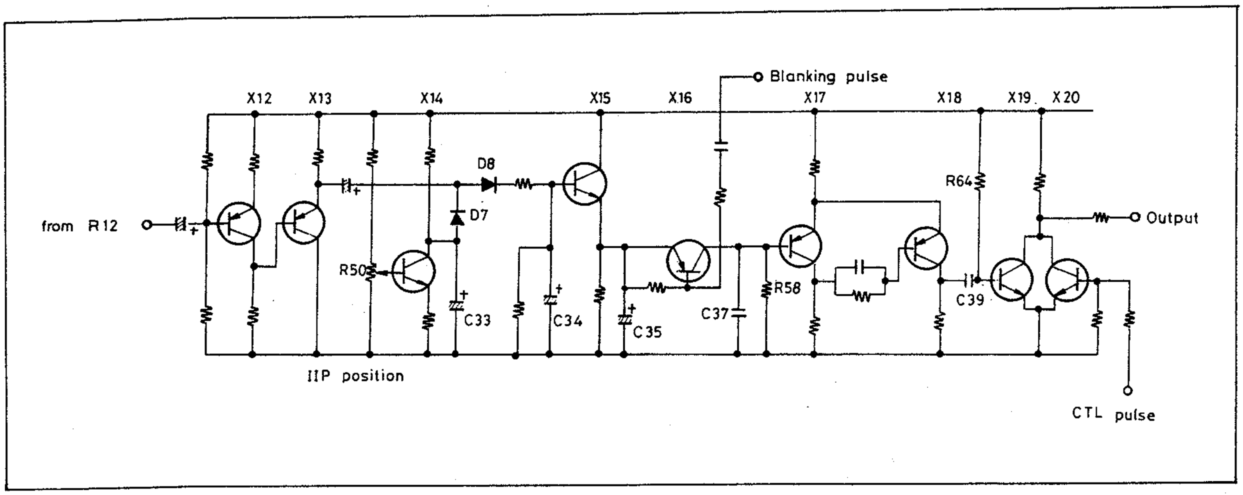
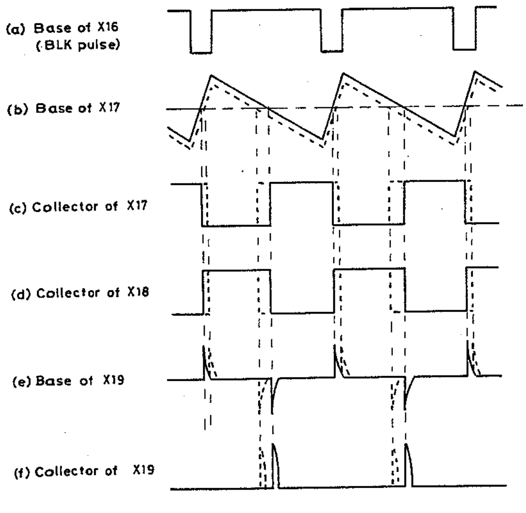

Blanking pulse
X12
X13
X14
X15
X16
X17
X18
X19
X20
D8
D7
R64
Output
from R12
R50
C33
C34
C35
C37
R58
C39
IIP position
CTL pulse

Fig. 2-40 IIP generator circuit

The DC voltage proportional to the magnitude of luminance signal is charged on the capacitor placed at the emitter of X15. On the other hand, X16 plays the role of a sampling gate circuit; it turns on only when a negative blanking pulse is applied to its gate. The charge on C35 charges C37 at the time constant determined by the saturated resistance between the collector and the emitter of X16 and C37.

Refer to Fig. 2-41 for the waveforms of the following description:



Note: The dotted line shows the case that the intensity of illumination of the subject drops.

Fig. 2-41 Waveform of Iris Indicator Pulse (IIP)

When the blanking pulse is lost, X16 is turned off and the charge on C37 is discharged through R58, and further, a sawtooth wave, as shown in the figure, is generated across C37. X17 and X18 constitutes the Schmidt trigger circuit, and X17 is normally turned on, while X18 normally cut off. When the base voltage at X17 changes in accordance with the sawtooth voltage, and that voltage decreases less than the emitter voltage, X17 turns on, while X18 turns off. This repetition causes the collector voltage waveform of X18 to the rectangular waveform as shown in the figure.

This voltage change is differentiated by C39 and R64, and fed to the base of X19. Though X19 normally turns on due to its fixed bias voltage, when a negative trigger pulse is applied, it is turned off for a moment and a positive pulse is developed at its collector. This is mixed with the video signal of V.F resulting in a white vertical line appearing in the viewfinder, and thus an iris indicator is formed, as illustrated in Fig. 2-42.

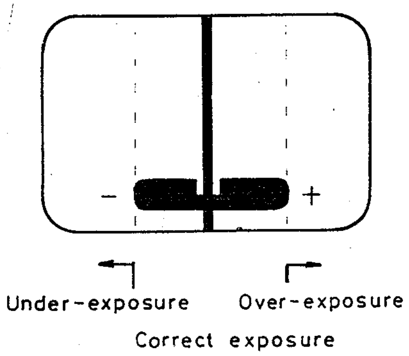


Fig. 2-42 Aperture indicator in the viewfinder

When the intensity of illumination of the subject drops, the video signal goes down, and the voltage held at C35 also goes down. Accordingly, as shown in the dotted line of Fig. 2-41, the sawtooth DC voltage level also decreases thereby allowing X17 to be forward biased sooner, causing its collector waveform to be shifted as shown by the vertical dashed lines of Fig. 2-41. Therefore the indicator pulse is developed at the point toward the left of center of the blanking interval of H. Consequently the iris indicator of the viewfinder goes from the center toward the left.

When at the standby condition (tape stopped with camera trigger in OFF position in the REC Mode), the IIP is generated for the vertical interval corresponding to the entire picture height on the viewfinder, while at the recording condition, it becomes shorter (9msec), about half the height of the picture, since the CTL pulse is applied to the base of X20. The reason is to make the picture on the VF easy to see while recording. (Refer to Fig.2-43.)

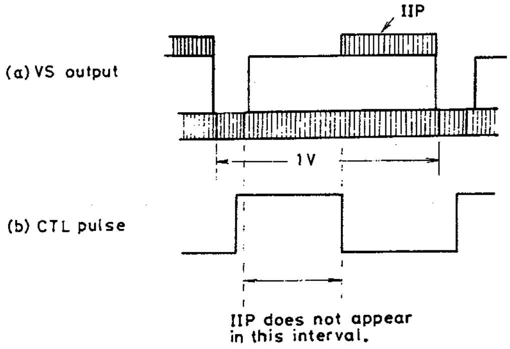


Fig. 2-43

2-5-2 Operations of each Part of CCU-1 Signal System

The printed circuit board of CCU-1 includes a pulse shaping circuit. In the first three items the operation of each signal system will be discussed. (The pulse shaping circuit will be explained in item 4.)

The principal operations of the CCU-1 signal system are that the color difference signals E_R-E_Y, and E_B-E_Y, are produced from the three primary color signals E_R, E_G, and E_B of the CCU-2 process amplifier outputs, and that the color carrier signal is developed by performing the orthogonal (quadrature) two-phase modulation to the color subcarrier, and that the NTSC-type signal is completed by mixing the Y and the composite sync signals.

1. Matrix Circuit and E_B-E_Y Amplifier Circuit (Refer to Fig. 2-44.)
   The CCU-2 process amplifier outputs are introduced to the G-IN (TP-15), the R-IN (TP-16), and the B-IN (TP-17), and the Y signal (0.30R + 0.59G + 0.11B) is produced at the resistance matrix circuit consisting of IC-14 through the emitter follower circuit consisting of X38, X39, and X40. This ratio is determined by the dividing ratio, R1 to R4, R2 to R4, and R3 to R4, and the Y signal is made by making the ratio as 0.30, 0.59, and 0.11. Next the color difference signals E_B-E_Y, and E_R-E_Y are produced from the Y signal. The operations are all the same for the respective color circuit, therefore only the E_B-E_Y amplifier circuit is explained here. However since no burst flag pulse is required for the E_R-E_Y amplifier, then this pulse circuit is not employed. The Y signal from the matrix is applied to pin 3 of IC-15, the base of Q1, through C75, and is amplified and its phase inverted, producing $-E_Y$. On the other hand, E_B is applied to the emitter of Q1 from the emitter of X40 through R168 and R147. The signal introduced to the emitter is amplified and appears at its collector without receiving phase inversion; thus E_B is produced. Accordingly these two signals are mixed at the collector side of Q1 thereby producing the color difference signal E_B-E_Y. Moreover the burst flag pulse is introduced to the emitter of Q1, and this becomes the reference burst signal at the ring modulator. (Will be mentioned later.) Next, R147 (WHITE BALANCE), R149(E_B-E_Y GAIN) will be simply explained.

   The R147 (WHITE BALANCE) adjusts the gain of E_B for the purpose of obtaining the condition E_B-E_Y when a white subject is picked up. That is, in the case of picking up the white subject, $E_B=E_G=E_R=1$ can be assumed, then E_B-E_Y equals to $1-(0.30+0.59+0.11)=0$. R149(E_R-E_Y GAIN) matches its gain with that of E_B-E_Y.

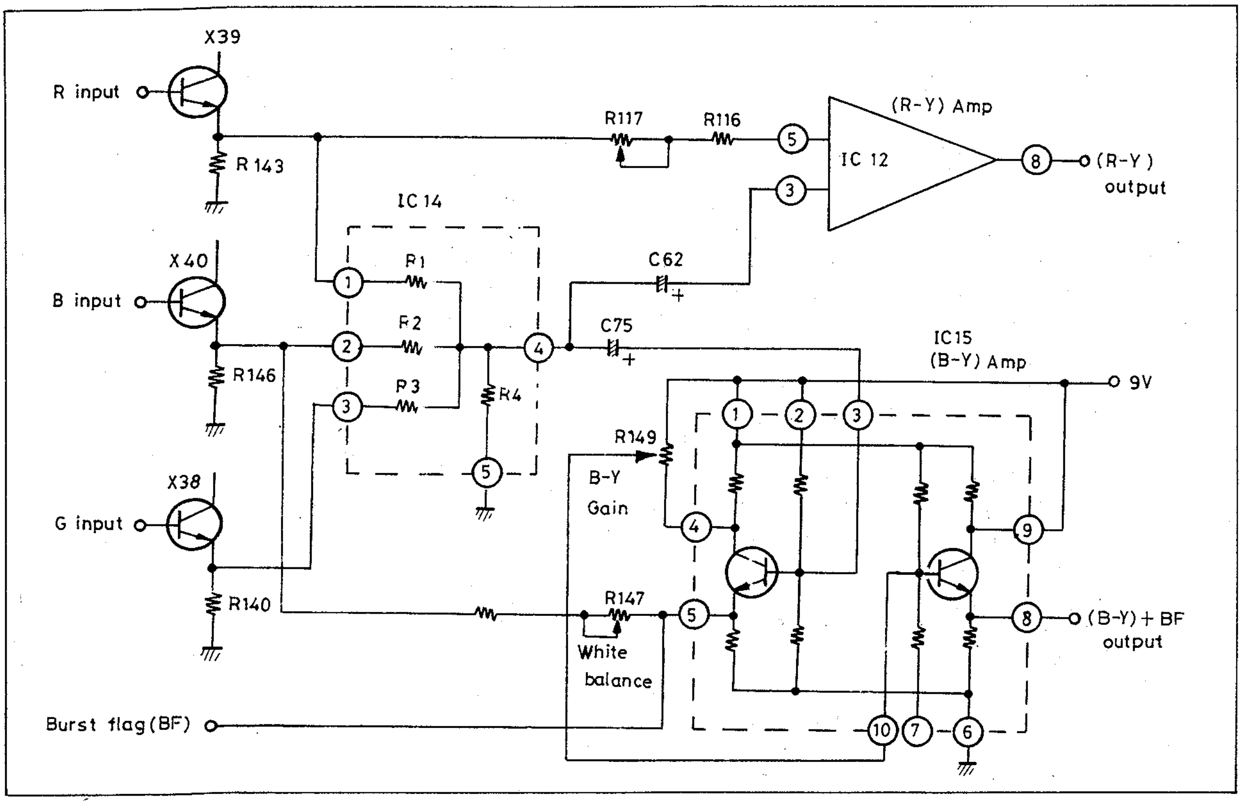


Fig. 2-44 Matrix and B-Y amplifier

2. Pedestal Clamp Circuit and Ring Modulator

In this NTSC-type system, for the purpose of superimposing the two color difference signals on the subcarrier, the carrier color signal is produced by performing amplitude modulation on the color subcarriers different respectively from their phase in 90 degrees and by adding together the side bands developed at that time. This modulation system is called quadrature or orthogonal two-phase modulation. In the actual circuit, each color difference signal is clamped at its pedestal and DC regeneration is performed. At the same time clamping ensures that tilt and other distortion which would result in leakage of the subcarrier at the pedestal level are prevented before being introduced to the ring modulator.

a. Pedestal clamp circuit and carrier balance circuit (Refer to Fig. 2-45 for the B–Y circuit. The R–Y circuit uses the same principle and basic configuration)

X41 is the clamper. The clamp pulse (1) is applied to its base performing the pedestal clamp operation. X43 constitutes the constant voltage circuit. Its emitter voltage is clamped at 4.7 volts and applied to the central point of the secondary winding of T4. R154 is the carrier balance potentiometer. By adjusting the bias voltage of the clamper, the emitter voltage of X42 is controlled so that the voltage is equalized to the emitter voltage 4.7 volts of X43 in the blanking interval. That is, the emitter voltages of X42 and X43 are equal to each other at the pedestal portion, since it reaches substantially the same result as if the modulating signal were zero, no output is carried. If, in this blanking interval, the emitter voltages of X42 and X43 are different from each other, the subcarrier modulated by it would be leaking , and the correct color reproducibility would be difficult for the receiver.

b. Principle of the ring modulator (Refer to Figs. 2-46, 2-47 and 2-48.)

Fig. 2-46 shows the actual ring modulator circuit. For the convenience of the explanation, the symbols used in here are decided as shown in the following.

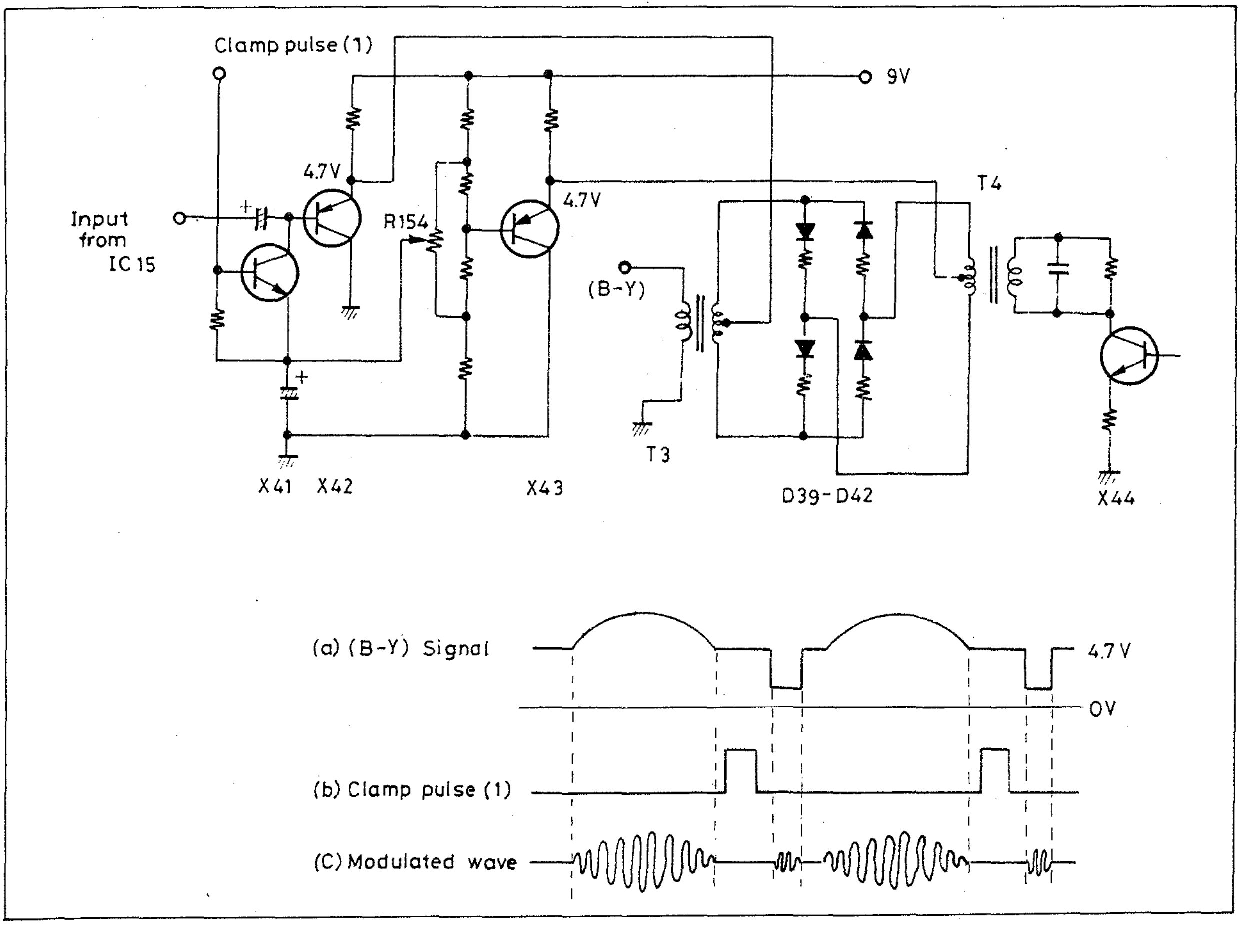


Fig. 2-45 Pedestal clamp and ring modulator

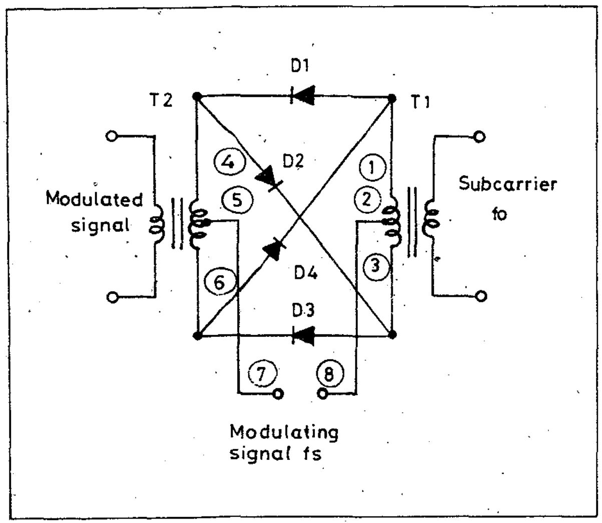


Fig. 2-46 Ring modulator

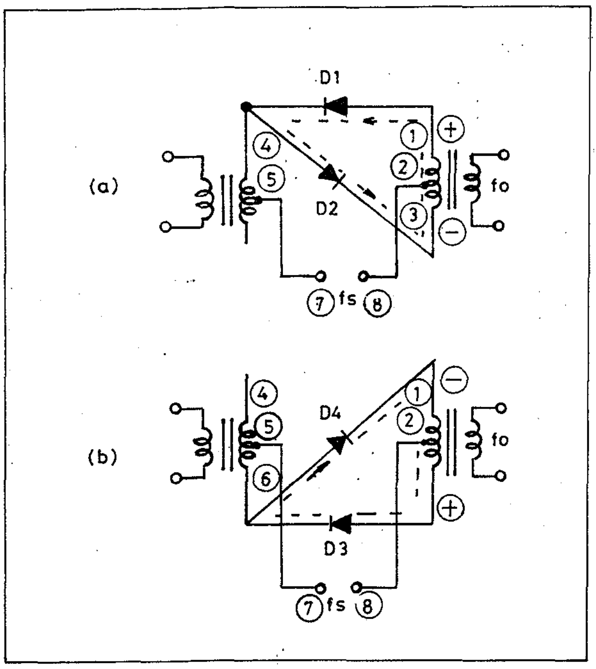


Fig. 2-47

Subcarrier f_O . . . . subcarrier positive means ① plus ③ minus at the terminals of the secondary winding of T1.

. . . . subcarrier negative means ③ plus ① minus at the terminals of the secondary winding of T1.

Modulating wave fs . the modulating wave positive means ⑦ terminal plus ⑧ terminal minus.

. . . . the modulating wave negative means ⑧ terminal plus ⑦ terminal minus.

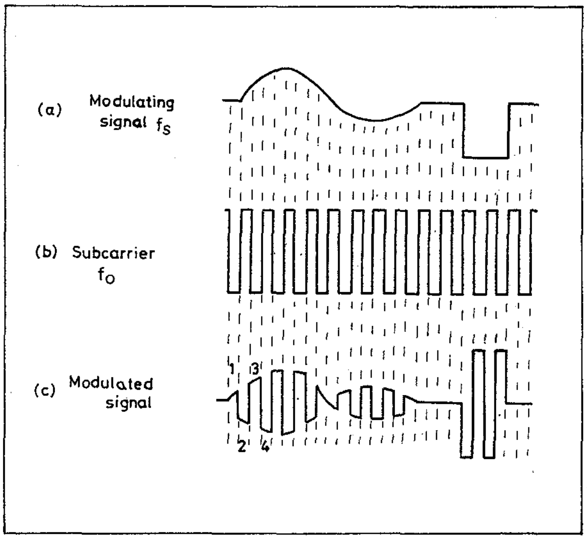


Fig. 2-48 Waveform of ring modulator

a) In the case of f_O = positive, f_S = 0, the current flows as shown in Fig. 2-47 (a) and the subcarrier cannot be brought into output.
   And in the case of f_O = negative, f_S = 0, the current flows as shown in Fig. 2-47 (b), and the subcarrier cannot be brought into output.

b) In the case of f_S = positive, f_O = positive, diodes D1 and D2 are turned on, then f_S is permitted to be flown as ⑦ – ⑤ – ④ – D2 – ③ – ⑦ – ⑧ , and the voltage corresponding to the dark shaded portion of one interval as shown in Fig. 2-48 (c) is induced at the secondary of T2.

c) In the case of f_S = positive, f_O = negative, diodes D3 and D4 are turned on, then f_S flows as ⑦ – ⑤ – ⑥ – D4 – ① – ② – ⑧, the f_S but in opposite phase as mentioned above explanation b) is induced at the secondary of T2. (Two intervals in Fig. 2-48 (c)).

d) In the case of f_S = negative, f_O = positive, diodes D1 and D2 are turned on, then f_S flows as ⑧ – ② – ① – D1 – ④ – ⑤ – ⑦ , and the phase of subcarrier is different from that of the modulated wave in 180 degrees and brought into output.

e) In the case of f_S = negative, f_O = negative, diodes D3 and D4 are turned on, then f_S flows as ⑧ – ② – ③ – D3 – ⑥ – ⑤ – ⑦, and the phase of subcarrier and that of the modulated wave are different from each other in 180 degrees and brought into output, as mentioned above explanation d).

f) When a negative burst flag pulse is introduced, the phase of output is differs from that of the subcarrier in 180 degrees, as mentioned above explanation d) and e), thus 3.58MHz in the same phase as −(B−Y), i.e., the burst signal is brought into output to the output of (B−Y).

3. Band Pass Amplifier and Comb Filter Circuit (Refer to Figs. 2-49 and 2-50.)

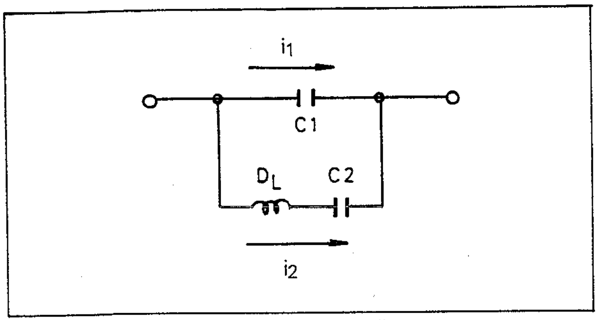


Fig. 2-49 Comb filter

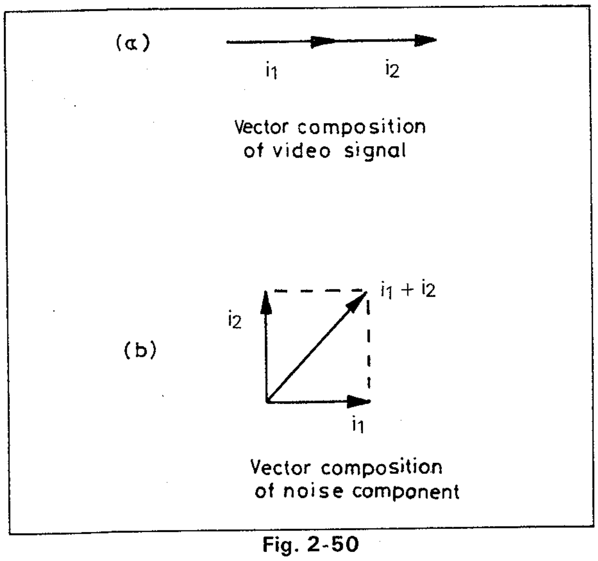

(a)
i1
i2
Vector composition of video signal
(b)
i1 + i2
i2
i1
Vector composition of noise component

Fig. 2-50

The color carrier signal received the two phase modulation by $E_R - E_Y$, and $E_B - E_Y$ ranges the band width of 3.58 ±0.5MHz. Therefore it is performed the band width amplification by means of the X33 band pass amplifier. C59 and L6 constitutes the series resonant circuit for 3.58MHz and C58 and L5 composes the parallel resonant circuit for 3.58MHz. For the color carrier signal amplified by the band pass amplifier, the signal-to-noise-ratio can be improved by about 3db by passing it through a comb filter. The basic principle of the comb filter will be explained here. D_L is the delay coil of which delay time is around 1H (63.5μsec). By this, the time difference between i_1 and i_2 becomes 1H. But for the television picture, since this is only a difference of one scanning line, then the waveform of i_1 and i_2 are almost the same. In this case, i_2 is the signal one scanning line ahead of i_1. Accordingly i_1 and i_2 are the resultant of the same phase, then the output is doubled (6db). On the other hand, the noise components, because of their irregularity, can be considered that they take various phase conditions each other such as the same phase condition at one time and the opposite phase condition at other time (the phase relationship between i_1 and i_2). But since it can be considered that they have the phase difference in 90 degrees average, the resultant of these noise component becomes $\sqrt{2}$ (3db). By this, the carrier color signal through the comb filter can be increased by 6db, while the noise component by only 3db. Therefore the signal-to-noise-ratio can be improved by 3db on the average.

4. Pulse Shaping Circuit

This part is comparable to the heart, for the camera. The output signals from the camera are all regulated by the pulse obtained by this pulse shaping circuit, and the NTSC-type signal specified can be produced. In the case of the GC-4800U, 13 types of pulses, as shown in the following, required for the signal shaping, are produced by the HD and VD pulse from the PV-4800U or GA-20U.

a. Types of pulses and applications

From HD PULSE

(1)PRE BLK P . . .	DCC
(2)HD OUT.	Vidicon deflection system, vidicon G1 (camera BLK) Static Shading, Y Set 3.58MHz OSC control
(3)CLAMP P(3) . . .	clamp of DCC input
(4)H BLK P	Process Amp, Sampling Gate of Iris Indicator Pulse, Blanking Noise Reduction
(5)H SYNC	Mixing Amp (Y signal, color carrier signal, composite SYNC signal)
(6)BURST FLAG P.	B-Y Amp (generates the burst signal)
(7)CLAMP P(1) . . .	Y Process
(8)CLAMP P(2) . . .	C Process

From VD PULSE

(1)V. BLK. P. . . .	to the same circuits as H BLK
(2)V. SYNC	to the same circuits as H SYNC
(3)SAMPLING P . .	DCC
(4)VD OUT	Vidicon deflection system, Vidicon G1
(5)CTL P	Iris Indicator Pulse Control Gate

Since the pulse shaping circuits for the GC-4800U usually consist of a monostable multivibrator using IC type 10HC2F, first, in the following paragraph, the principle of operation of the monostable multivibrator circuit will be explained. Then, examples of circuits which generate several of the pulses listed in (4a) above will be given in (4c, d). Other pulse circuits will not be explicitly described, since they are substantially similar to the examples.

b. Principle of monostable multivibrator using 10HC2F (Refer to Figs. 2-51 and 2-52.)

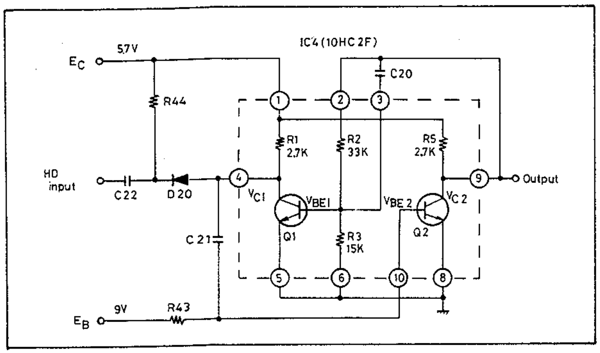


Fig. 2-51 Monostable multivibrator

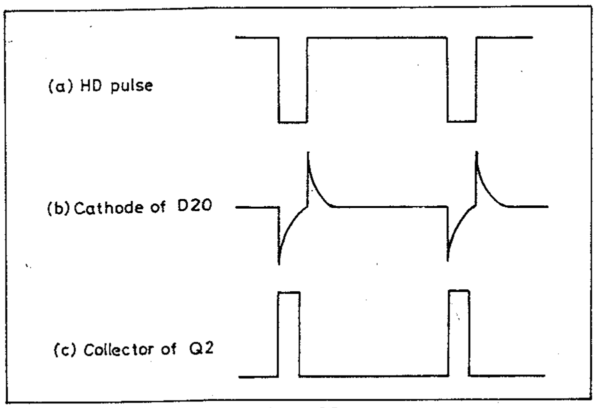


Fig. 2-52

Since Q2 is given fixed bias through R43; then it normally turns on. Accordingly the collector voltage V_{C2} is around 1 volt. Since this collector voltage is divided by R2, 33k ohms, and R3, 15k ohms, and fed to the base of Q1, Q1 cannot turn on, that is, $V_{BE1} = V_{C2} \times R3 / (R2 + R3)$. This is the stable condition. Consequently the collector voltage of Q1 is about 5.7 volts, and C21 is charged to about 5 volts positive at terminal 4 with reference to terminal 10 ($V_{BE2} + E_{C21} = V_{C1}$). When a negative pulse is applied through C22 at this stable condition, it reaches the same result that the plus side of C21 is momentarily grounded. Therefore, about (−5) volts is applied to the base of Q2 for a moment, thereby causing Q2 to turn off. V_{C2} goes up by turning off of Q2, then V_{BE1} becomes more than 0.6 volt thereby causing Q1 to turn on. Since the charge of C21 discharges through the collector of Q1, the emitter of Q1, ground, and R43, V_{BE2} increases exponentially. Q2 remains off until V_{BE2} becomes more than 0.6 volt. As soon as it reaches more than 0.6 volt, Q2 turns on resulting in the circuit again returning the stable condition. Since the output pulse is picked up from the collector of Q2, the pulse width T is determined by the time that Q2 turns off, and its time constant can be expressed by the following equation.

$$T = C21 \times R43 \log[(E_B + E_C)/E_B]$$
$$= C21 \times R43 \log[(9+5.7)/9] \doteqdot C21 \times R43 \times 0.5$$

where; E_B the voltage applied to the base circuit: 9 volts

E_C the voltage applied to the collector circuit: 5.7 volts

c. CLAMP P(3), HD P, PRE BLK P generator circuit Refer to Figs. 2-53 and 2-54. Outline of the principal operation for the circuit will be described as shown in the following.

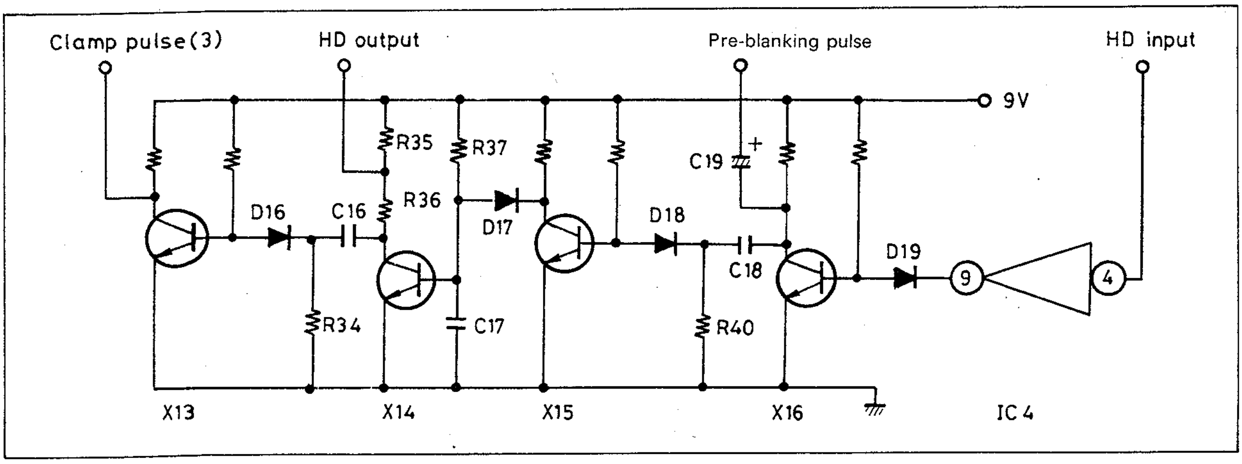


Fig. 2-53 Clamp pulse (3), HD pulse and Pre-blanking pulse generator

X16: INVERTER (phase inversion)
C18, R40; Phase shift by means of differentiation (the same for C16, R34)
R37, C17; Phase shift by means of integration
D17; Level shift diode
D16, D18, D19; Triggering diodes

d. CLAMP P (2) generator circuit (Refer to Figs. 2-55 and 2-56.)
Clamp pulse is generated by turning on of X9. Therefore it is required for this purpose that both X11 and X12 be turned off. Accordingly by adjusting R30 (Clamp Timing), as shown in Fig. 2-56, the clamp pulse in 2.8μ sec can be generated.

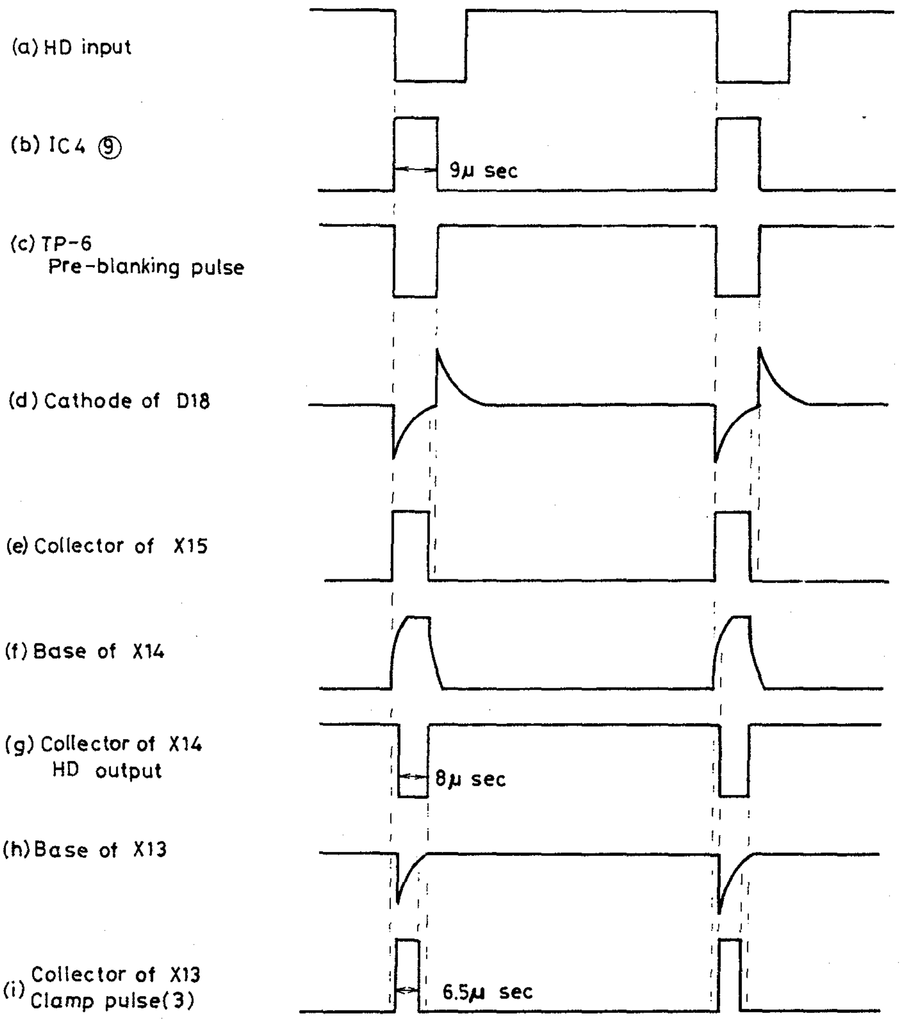

(a) HD input
(b) IC4 ⑨
9μ sec
(c) TP-6 Pre-blanking pulse
(d) Cathode of D18
(e) Collector of X15
(f) Base of X14
(g) Collector of X14 HD output
8μ sec
(h) Base of X13
(i) Collector of X13 Clamp pulse(3)
6.5μ sec

Fig. 2-54

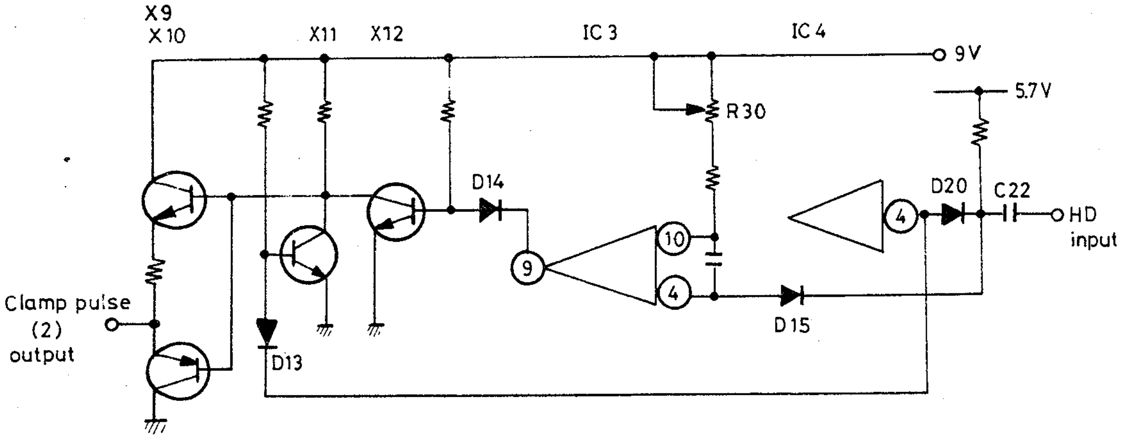

X9
X10
X11
X12
IC 3
IC 4
9V
5.7V
R30
D14
D20
C22
HD input
10
9
4
4
D15
Clamp pulse (2) output
D13

Fig. 2-55 Clamp pulse (2) generator circuit

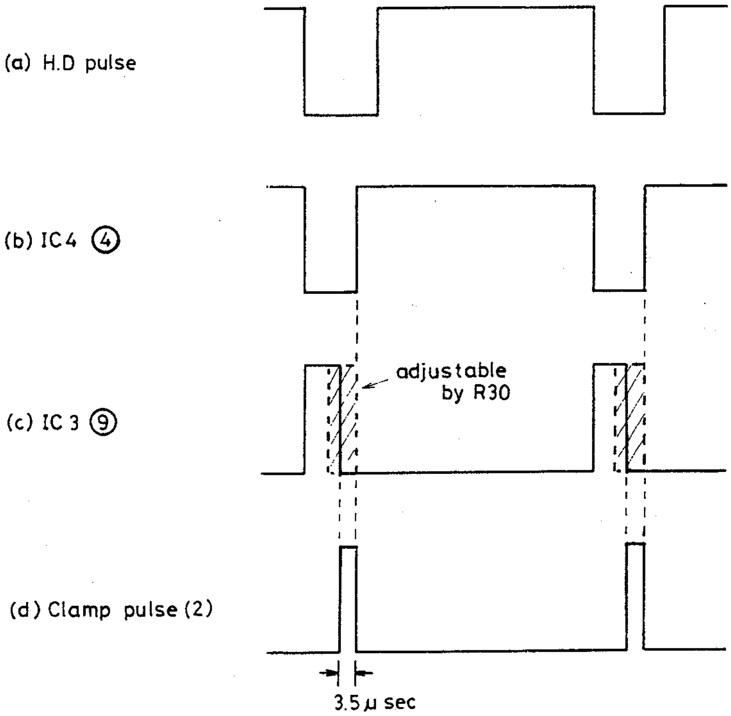

(a) H.D pulse
(b) IC4 ④
(c) IC 3 ⑨
adjustable by R30
(d) Clamp pulse (2)
3.5 μ sec

Fig. 2-56

SECTION 3
DISASSEMBLY

3-1 REMOVAL OF COVERS

3-1-1 Camera Head

Remove the handgrip from the camera. Next remove the eight screws ① which are located on the top and bottom of the camera. The side covers may now be pulled off. You may replace the handgrip for easy handling. See Fig. 3-1.

3-1-2 CCU

Remove four screws ① and take off the top cover. Next remove four screws ② and take off the bottom cover. See Fig. 3-2.

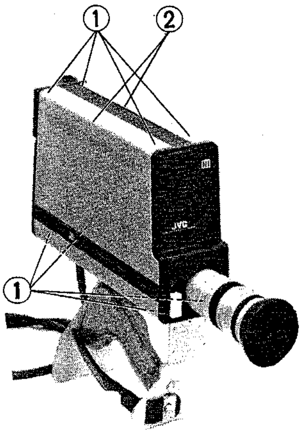


Fig. 3-1

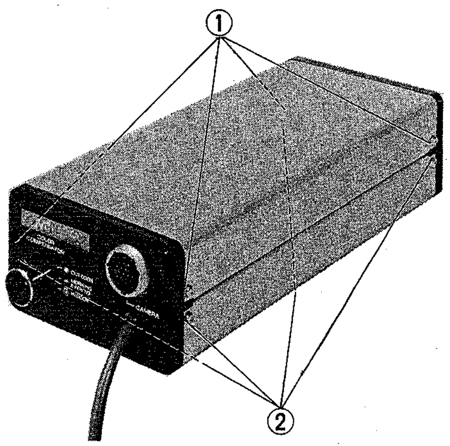


Fig. 3-2

3-2 LOCATION OF PRINCIPAL PARTS OF THE CAMERA HEAD

3-2-1 Side 1 of the Chassis

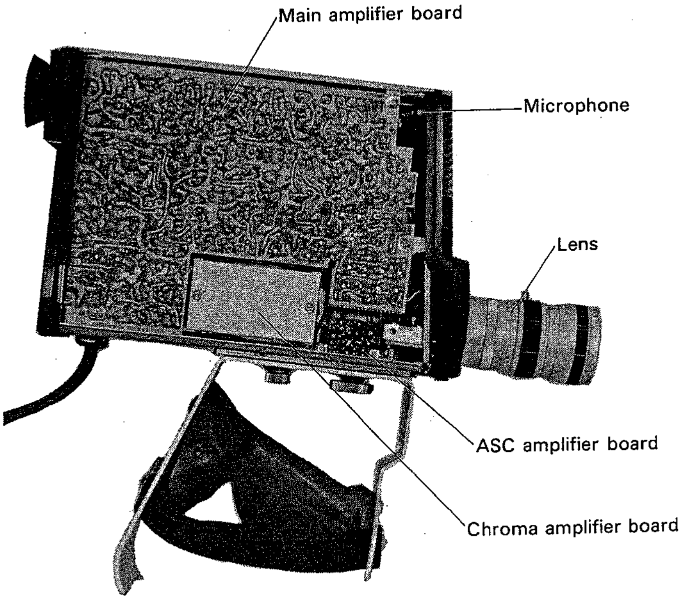

Main amplifier board
Microphone
Lens
ASC amplifier board
Chroma amplifier board

Fig. 3-3

B. CCU-2 Board

1) Remove four screws ①. (Fig. 3-11)

2) The circuit board can be removed together with stay 3 and 4.

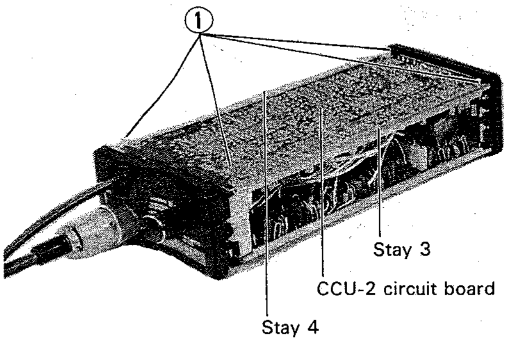


Fig. 3-11

3-4 REPLACEMENT OF OPTICAL BLOCK ASS'Y

3-4-1 Removal Procedure for the Optical Block Assembly

1. Remove the handgrip and side covers from the camera head as described in 3-1-1.
2. Remove the two screws in the front of the top cover, Fig. 3-12, ① and the two screws in the rear of the top cover, Fig. 3-12, ②, and lift it off.
3. Remove the main amplifier board as described in 3-3-1 (A).
4. Remove the two mounting screws for the chroma pre-amplifier board as described in 3-3-1 (B).
5. Disconnect the four pin-jacks connected to the main amplifier board (J7, J14, J15 and J18).
6. Remove the Y-preamplifier board as described in 3-3-1 (D).
7. Disconnect the two springs, Fig. 3-13 ① which are connected between the chroma vidicon socket and the chroma deflection yoke.
8. Carefully remove the vidicon sockets ② and ③ of both vidicons.
9. Unsolder the two wires ④ and ⑤ connected between the deflection yokes and the terminal strips.

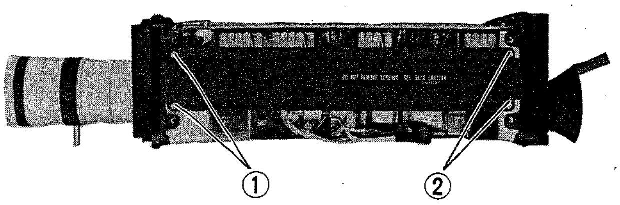


Fig. 3-12

10. Remove the four screws ⑥ in the optical block cover.
11. Carefully remove the lens.
12. Take off the base assembly which is mounted on the bottom of the camera (seven screws). See Fig. 3-14, ①, ② and ③.
13. Very carefully remove the optical block assembly.

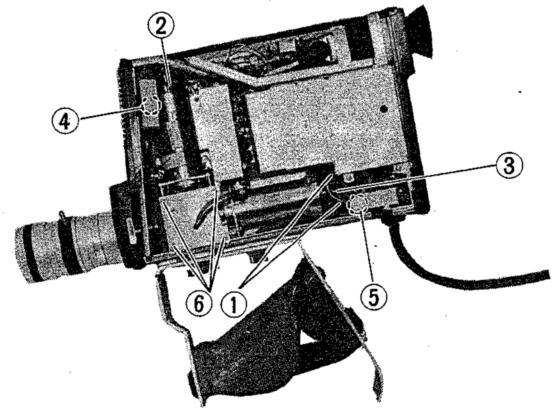


Fig. 3-13

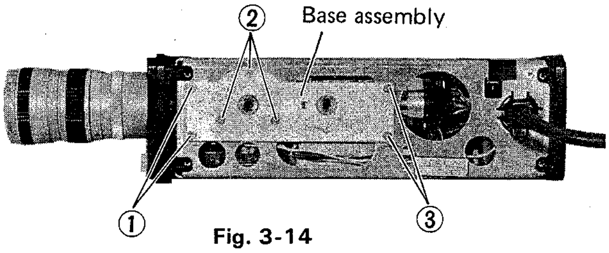


Fig. 3-14

3-4-2 Mounting Procedure for the Optical Block Ass'y

NOTE: The optical block assembly requires highly specialized optical equipment to align its component parts. Never attempt to disassemble or adjust the assembly. After mounting, the prism and lens should be cleaned with a soft lint-free cloth.

1. Install and mount the optical block assembly. Refer to "Removal Procedure for the Optical Block Assembly", subsection 3-4-1, reversing steps.
2. Install the chroma and luminance pre-amplifier boards.

   NOTE: It is very important that the wires of the deflection coil are soldered to the correct points.
3. Connect J7, J14, J15 and J18 to the indicated points on the main amplifier circuit board.
4. After completion of the optical block assembly installation follow the instructions given in the ALIGNMENT PROCEDURE, Section 4.

3-5 REPLACEMENT OF VIDICONS

3-5-1 Replacement of the Luminance Tube

NOTE: When the Y-tube is replaced, the following conditions must be satisfied.
1) Optical position of chroma tube is normal, and must not be moved.
2) Camera head amplifier and camera control unit are normal.

A. Removal procedure for the Y-vidicon

1. Remove the side covers from the camera head. See 3-1-1.
2. Remove the four screws in the top cover and lift it off. See Fig. 3-12.
3. Carefully remove the lens.
4. Referring to Fig. 3-15, remove the two screws of the front cover assembly and remove.
5. Remove the seven mounting screws for the base assembly on the bottom of the camera. See Fig. 3-14.
6. Remove the four screws which secure the block cover and gently pull forward. See Fig. 3-16.

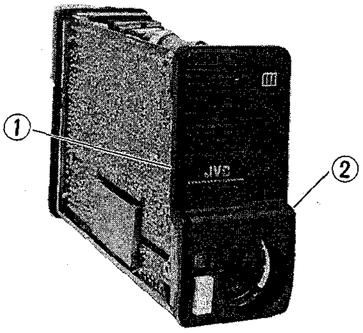


Fig. 3-15

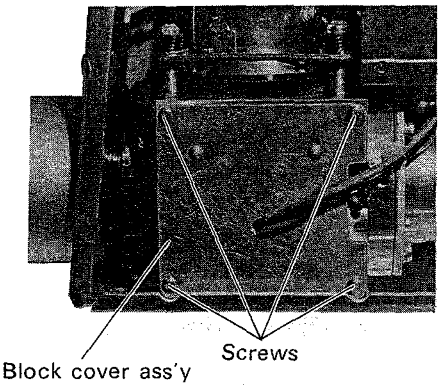
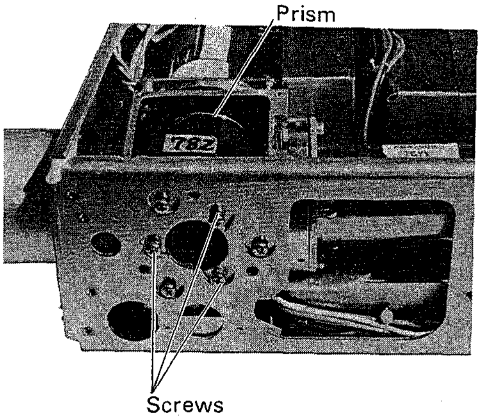


Fig. 3-16

7. Remove the three mounting screws for the prism on the bottom of the camera head, and pull off the prism very carefully. See Fig. 3-17.
8. Remove the vidicon socket and release clamp (present in some camera heads) for Y-tube. See Fig. 3-18.
9. Turn camera head on its side, with optical assembly visible.
10. Turn the vidicon base counter-clockwise using a regular screwdriver and take off, along with retainer. See Fig. 3-20. Be certain to guard against the vidicon dropping due to support being removed.
11. Push the Y-tube from the socket-side, and then draw out through the opening in the camera chassis base beneath the optical block.



NOTE: Do NOT loosen other screws.

Fig. 3-17

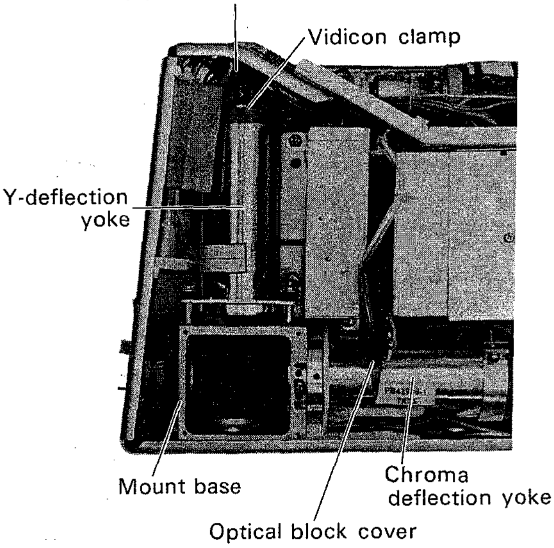


Fig. 3-18

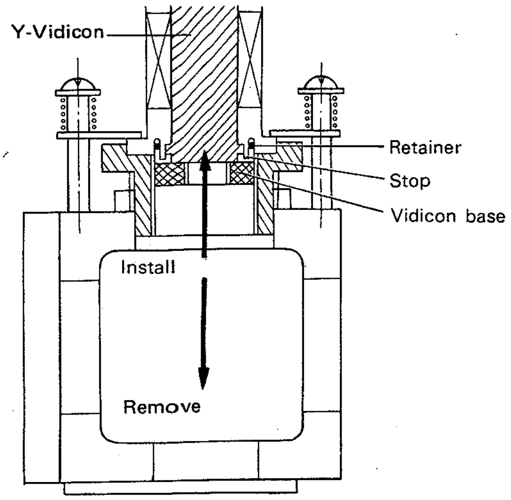
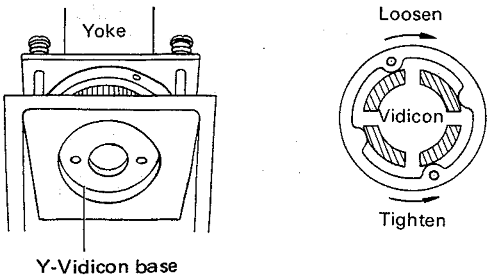


Fig. 3-19



View through optical block after removal of prism
(a)

Detail of Retainer
(Shown in tightened position)
(b)

Fig. 3-20

B. Mounting procedure for the Y-vidicon

Refer to A. "Removal procedure for the Y-vidicon" for additional details.

- Wipe the new vidicon's surface completely clean.

1. Be certain to check that the position of the key-way of the vidicon is 90 degrees from the target lead on the yoke viewing from the vidicon faceplate. Gently push vidicon until it reaches the stop. See Fig. 3-19.
2. Holding vidicon faceplate (with tissue) against stop, plug in the vidicon socket. Wipe faceplate clean with lens tissue, otherwise picture may be degraded.
3. Be certain that the prism is free of fingerprints or dust, cleaning with lens tissue if necessary, and install. Temporarily fasten the three mounting screws. Further adjustment will be performed.
4. Install the lens.

NOTE: The vidicon is the heart of the video camera. Flaws can result from shocks greater than 2.5G. A jet of air from a squeeze-blower should be used before cleaning with tissue if considerable dust is present.

C. Alignment of Y-vidicon

1. Refer to ALIGNMENT PROCEDURE subsections 4-1 through 4-4, and 4-5, steps 7 through 9 (using resolution chart).
2. Next refer to subsection 4-7-10 in ALIGNMENT PROCEDURE, following the steps regarding Y-vidicon.

3-5-2 Replacement of the Chroma Tube

NOTE: When the Chroma-tube is replaced, the following conditions must be satisfied.
1) Optical position of Luminance-tube is normal, and must not be moved.
2) Camera head amplifier and camera control unit are normal.

A. Removal procedure for the chroma tube

1. Remove the side covers from the camera head. See 3-1-1.
2. Remove the four screws in the top cover and lift it off. See Fig. 3-12.
3. Carefully remove the lens.
4. Referring to Fig. 3-15, remove the two screws of the front cover assembly and remove.
5. Remove the seven mounting screws for the base assembly on the bottom of the camera. See Fig. 3-14.
6. Remove the four screws which secure the optical block cover and gently pull forward. See Fig. 3-16.
7. Remove the three mounting screws for the prism on the bottom of the camera head, and pull off the prism very carefully. See Fig. 3-17.
8. Remove the two springs attached to the chroma tube socket; but do NOT remove the socket at this time. Refer to exploded view of Optical Block Assembly, subsection 6-4, parts numbered ㉙ .
9. Turn the adjusting ring (C) counter-clockwise using a regular screwdriver in slots and remove. See Fig. 3-21.

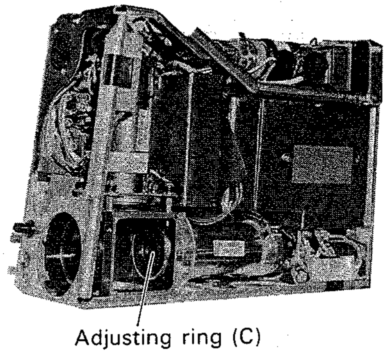


Fig. 3-21

10. Remove the adjustment screw, then loosen the two setscrews (with a metric hex driver) two turns. See Fig. 3-22.

11. Carefully remove the chroma vidicon, along with the filter mount/screen guide assembly, by pushing the socket of the chroma tube forward, slowly. Detach socket when chroma vidicon may be grasped by faceplate and pulled through lens opening.

NOTE: Take care that no thumb-prints or other marks are left on the stripe filter, vidicon or prism.

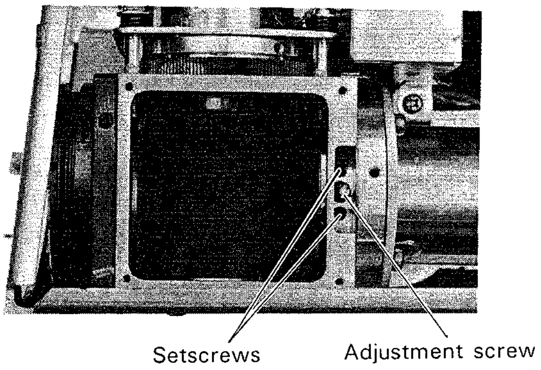


Fig. 3-22

B. Mounting procedure for the chroma tube

1. Wipe any thumb-prints or other marks clean by using lens cleaning paper on the faceplate of chroma tube.
2. Insert the chroma tube through lens opening carefully holding faceplate with lens tissue so that the position of the keyway becomes horizontal, pointing to the left, as viewed from the lens side. See Fig. 3-23.

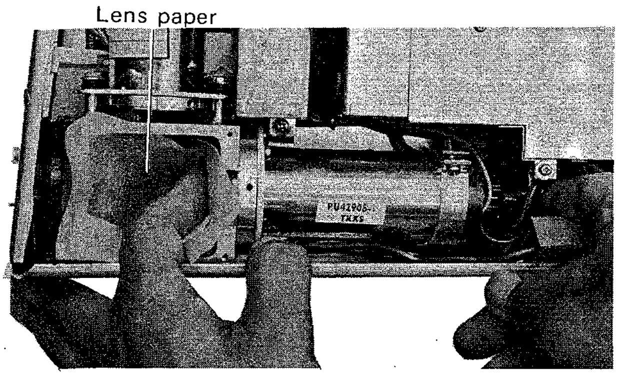


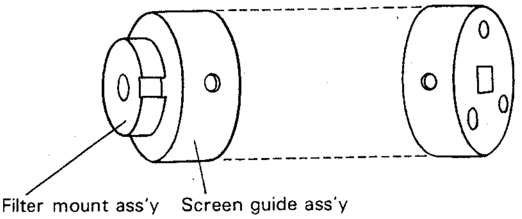
Fig. 3-23

NOTE: During insertion, the vidicon stop provides spring pressure action, so just enough pressure must be applied to properly seat the tube against the stop. However, be certain that excessive force is not applied as this can result in damage to the vidicon.

3. Wipe the vidicon faceplate clean again.
4. Insert the filter mount/vidicon screen assembly, taking care that key-notch in filter mount assembly is positioned behind adjustment screw. See Fig. 3-24. Fasten the adjustment screw temporarily. See Fig. 3-25. Re-check that adjustment screw is in the key-notch of the filter mount assembly.
5. Put the adjusting ring (C) and turn it clockwise until it reaches bottom.
6. With adjustment screw just tight enough so that contact with the key-notch of the filter mount assembly will prevent rotation, tighten the two setscrews with a metric hex key. Now, tighten the adjustment screw.

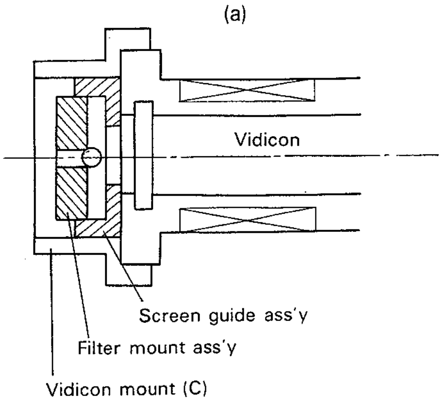
   NOTE: Avoid overtightening of screws to prevent mechanical distortion of assembly, which would inhibit later adjustments.

7. Carefully plug the vidicon socket into chroma tube pins and re-attach the two springs.
8. Carefully install the prism, and fasten temporarily with the three mounting screws on the camera base.
9. Install the zoom lens.



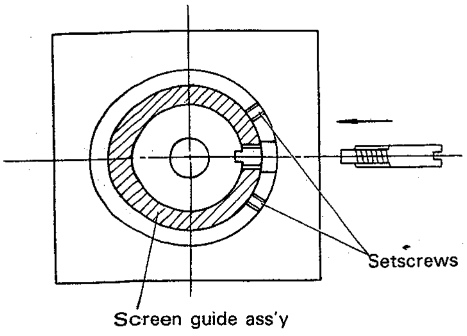
(Check the direction and movement of the filter mount ass'y)

(a)

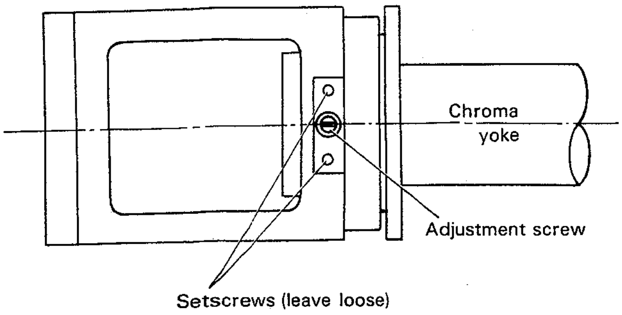


(b) Cross-sectional view

Fig. 3-24


Setscrews
Screen guide ass'y

(a) Front view


Chroma yoke
Adjustment screw
Setscrews (leave loose)

(b) Side view

NOTE: Do NOT tighten setscrews too tight to avoid mechanical distortion of ass'y.

Fig. 3-25

C. Alignment of chroma vidicon

1. Refer to ALIGNMENT PROCEDURE subsections 4-1 through 4-4, and 4-5, steps 10 through 13.
2. Next refer to subsection 4-7-10 in ALIGNMENT PROCEDURE, following the steps regarding chroma vidicon.

SECTION 4
ALIGNMENT PROCEDURE

4-1 INTRODUCTION

The procedure of this section is to be used for alignment of the GC-4800U color video camera and its associated CCU, under 3200° Kelvin illumination.

4-2 ALIGNMENT EQUIPMENT

4-2-1 Equipment Required

The following equipment is required in order to perform the alignment:

Oscilloscope : Tektronix 465, or equivalent
Monochrome monitor : High-resolution type with underscan
Color monitor : Tektronix 650, or equivalent
Camera adapter : JVC GA-20U
Lighting : Two 250W photofloods in 12" reflectors, or Smith-Victor 750 with 500W quartziodide lamp, or equivalent
Light meter : Gossen Tri-Lux foot-candle meter, or equivalent
Neutral density filters : ND-2(0.3/50%), ND-4(0.6/25%), and ND-8(0.9/12.5%), 48mm (Tiffen or equiv.) (avail. from JVC)
JVC Test patterns* : JVC SPS-4800U Special Pattern Set, consisting of the following charts:

1. Chroma/Luminance (C/Y) Registration
2. White Field
3. Set-up, 90% APL
4. Video Level/AGC, 50% APL
5. Clip Level, 20% APL
6. ASC, 50% APL

Standard test patterns :

1. Resolution, EIA/RETMA or equivalent
2. Linearity, EIA or equivalent

Back-Focus wrench set*: JVC PUJ40543/PUJ40544
Adjustment screwdriver: Fuller Tool Co.
152-35 10th Ave.
Whitestone, N.Y. 11357
Screwdriver No.301, or equiv.
Two pieces, one modified as per footnote to subsection 4-6-1(7), and one unmodified

4-2-2 Recommended Equipment

Generator for crosshatch: Tektronix 140 or equivalent
Shading/Sensitivity Jig*: JVC SSJ-1

NOTE: The JVC Test Jig for Shading/Sensitivity, SSJ-1, is a fixture designed for use in alignment of the JVC color portable camera, GC-4800U. Although adjustment of sensitivity and shading is possible without SSJ-1, precise and consistent results are much more easily achieved with the aid of the Shading/Sensitivity Test Jig.
In the Alignment Procedure following, the steps for which the SSJ-1 applies are divided into two parts, one titled "Without SSJ-1" and the other "With SSJ-1". Those who have no jig should follow the former and those who have an SSJ-1, the latter.

Stand for Test Patterns: (Frame Assembly)
Telecommunications Industries, Ltd.
6335 Homewood Ave.,
Suite 204, Los Angeles,
California 90028
Model No.001-20, or equivalent
(Resolution and Linearity charts are available to fit above stand, into which the JVC SPS-4800U charts fit also.)

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*Available in JVC GC-4800U Alignment Kit

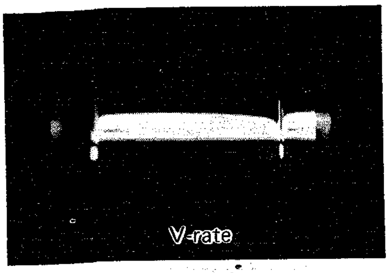

Fig. 4-2

6. Use the resolution chart and lighting recommended in subsection 4-4. Open the iris until a picture appears on the monitors. Adjust R336 (H. WIDTH) and R350 (V. HEIGHT) to overscan the camera vertically and horizontally. If the target ring is still not visible on the monitor, it may be necessary to adjust R390 (Y-BEAM) until it can be seen.
7. Focus the zoom lens, then adjust R413 (Y-FOCUS) on the Main Amplifier board for sharpest focus.
8. Slowly open the iris until the signal level at TP-1 on the CCU-2 board is 0.5Vp-p. Adjust R390 (Y-BEAM) until the signal just begins to be limited.
9. Adjust R418, Y-channel horizontal alignment (Y. H. A.) and R419, Y-channel vertical alignment (Y. V. A.) for the best corner focus, observing the resolution wedges of the corner circles on the black-and-white monitor.
10. Replace the resolution chart with the C/Y Registration Pattern, Chart No. 1, and adjust the iris until chroma appears on the color monitor*.
11. Adjust R412 (C-FOCUS) located on the Main Amplifier board for optimum chroma focus, which corresponds to maximum chroma level on the monitor.
12. Open the iris until the chroma signal is 0.5Vp-p as observed at TP-3 on CCU-2. Adjust R389 (C-BEAM) until the signal starts to limit.
13. Adjust R422, chroma horizontal alignment (C.H.A.) and R423, chroma vertical alignment (C.V.A.) for the best chroma alignment as observed on the color monitor. Misalignment appears as shading (false colors) near edges of the raster. Shading at the top and/or bottom indicates vertical misalignment, and at the left and/or right shows horizontal alignment error. After adjustment of R422 and R423, C-FOCUS must be readjusted as in step 11, above. Then readjustment of R422 and R423 is to be performed. Repeat the cycle again if necessary due to control interaction.

The preliminary adjustments are now complete. You are now ready to proceed with the overall alignment procedure, following.

4-6 BASIC SET-UP

4-6-1 Scanning Adjustments

1. Connect the oscilloscope to TP-3, chroma input (C-IN) on the CCU-2 P.C. board. Ascertain that the chroma signal is present.
2. With C/Y Registration Chart No. 1 as the test pattern, refer to subsection 4-3 and verify that the proper physical set-up still exists between the camera and the pattern. With both monitors underscanned zoom the camera lens until the entire chart is visible on the monitors. Adjust the center of the vidicon ring and the image of the chart to the same center by moving the camera or the pattern. However, keep the chart surface perpendicular to the camera-chart axis. See Fig. 4-3.

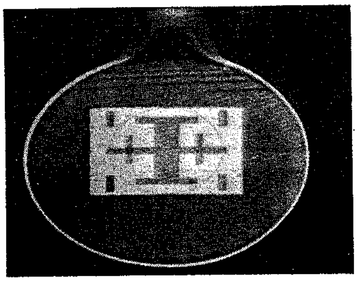

Fig. 4-3

Now, move the scope probe to TP-6 (2 MHz signal) on CCU-2 board. Adjust R336 (H. WIDTH), located on the Main Amplifier board in the camera head, for maximum signal amplitude at the center of the H-rate signal waveform. There are two points within R336's range which yield maximum amplitude; the one which provides the widest image on the monitor is the correct point.

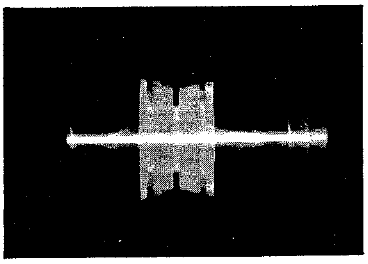

Fig. 4-4

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*However, the chroma will generally have an overall blue appearance and will not correspond with scene colors until scanning adjustments are performed (subsection 4-6-1).

3. Adjust R310, horizontal chroma centering (H. C. CENT.) on the Main Amplifier board to center the chroma signal with respect to the monitor raster observing for approximate horizontal registration (final registration will be performed in steps which follow). Adjust the zoom lens while performing the centering with R310, in order to bring the wedges at the sides of Test Chart No.1 to the edges of the monitor raster. See Fig. 4-5.

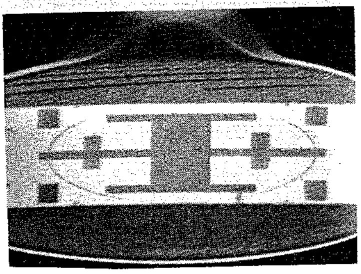


Fig. 4-5

4. Adjust R350 (V. HEIGHT) for the correct 3:4 aspect ratio. Both chroma and luminance are affected by this adjustment in which the wedges at the top and bottom of the raster are set to reach the vertical limits of the raster.

   NOTE: In case chroma is missing from a portion of the rectangular corner boxes of Test Chart No. 1, adjust R367, vertical chroma centering (V. C. CENT.) until all four boxes contain chroma throughout their areas.

5. Connect the oscilloscope probe to TP-3 (CHROMA IN) on the CCU-2 board. Replace the C/Y Registration chart with the White Field pattern, Test Chart No. 2, and zoom to close-up. Set iris to f2. Adjust R367 (V. C. CENT.) to blank chroma video for the last six horizontal lines prior to vertical blanking, in order to establish proper dark-current regulation as intended for the camera system design concept of the GC-4800U. See Fig. 4-6.

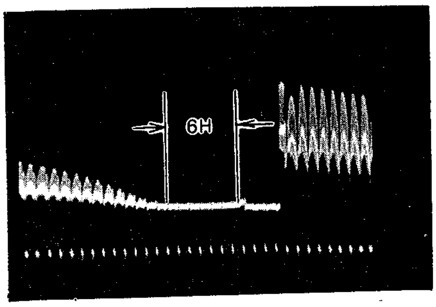


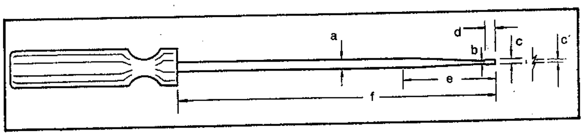
Fig. 4-6

6. Replace the White Field chart with the C/Y Registration pattern, Chart No. 1, and zoom so that the wedges of the chart touch the edges of the raster. Because of the adjustment of the previous step, the last six lines of chroma information will be blanked, which is normal for this system. As a result of video processing in the CCU, system blanking covers these lines.
7. Adjust R373, vertical luminance centering (V. Y. CENT.), R376, vertical luminance sub-height (V. SUB HEIGHT), R315, horizontal luminance centering (H. Y. CENT.), and L304, horizontal luminance sub-width (H. Y. SUB WIDTH)* to properly register the picture. In the event a skew error exists between the luminance and chrominance signals, adjust R340 to provide correction. See Fig. 4-7.

The camera should now be correctly centered and registered. However, in case that some residual errors still exist in various parts of the raster, give preference to the center and areas which are located near the center in making further corrections (repeat steps 2 through 7, above if necessary).

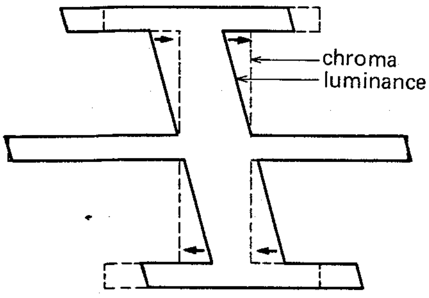
---

*For adjustment of L304 (H. Y. SUB WIDTH), which normally may need adjustment only upon replacement of optical block or vidicon(s), a pocket screwdriver (Fuller No. 301, or equivalent) should be modified to the dimensions below:
(Cover blade with heat-shrink insulation, except at tip.)



DIM.	ENGLISH	METRIC
a**	0.10"	2.5 mm
b	0.02"	0.50 mm
c	0.04"	1.0 mm
c'(tip — rotated 90°)	0.01"	0.25 mm
d	0.08"	2.0 mm
e***	1.0"	25 mm
f***	3.4"	86 mm

**nom.
***min.
**nom. ***min. other dims. ±0.004" or ± 0.10 mm



Adjust R340 to form a single line.

Fig. 4-7

4-6-2 Linearity Adjustments

In most cases, steps 1—3 below are NOT necessary, except when deflection-related components have been replaced. For other cases, prior to making any adjustments, feed the output of a crosshatch generator* into each monitor (b & w and color) and adjust for best possible linearity. Use the monitor with better linearity characteristics as reference while performing the three steps following:

1. Use the EIA Linearity "Ball" chart. Zoom to fill the monitor screen with the image of the chart. Check for vertical and horizontal linearity by careful visual inspection. Unless an appreciable error exists, skip steps 2 and 3 below, and proceed to the next subsection. Perform steps 2 and 3 if the error is large.
2. For correction of horizontal linearity, adjust R331 (H. LIN) for even horizontal spacing.
3. For vertical linearity errors, adjust R347 (V. LIN) for uniform vertical spacing. After horizontal and vertical linearity have been adjusted, steps 2—7 of subsection 4-6-1 should be rechecked and readjustments made as necessary.

4-7 SENSITIVITY AND SHADING ADJUSTMENTS

4-7-1 Sensitivity and Beam Adjustments

The light reflected from the charts is the input for the sensitivity adjustments. Therefore, before proceeding check subsection 4-4, LIGHTING, to make sure that the color temperature and light level are correct.

1. Luminance channel

   Connect the oscilloscope to TP-1 (Y-IN) on the CCU-2 board. Attach an ND-8 filter to the lens and set the iris to f2. Using the White Field, Chart No. 2, as the subject, adjust R410 (Y-TARGET) located on the Main Amplifier for a p-p signal of 0.3 volts. See Fig. 4-8.

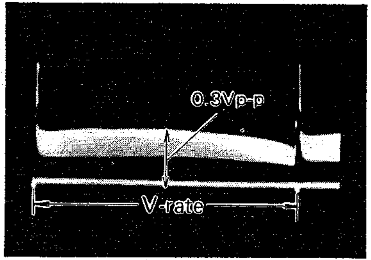


Fig. 4-8

Now close the iris completely and adjust R317 (Y-SETUP) on the Main Amplifier board for zero set-up level. See Fig. 4-9.

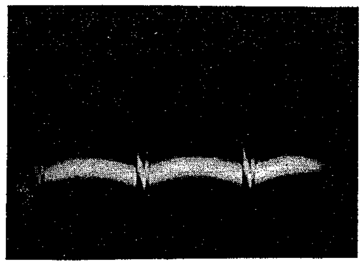


Fig. 4-9

Replace the ND-8 filter with the ND-2, and set the iris to f2. Adjust R390 (Y-BEAM) on the Main Amplifier until the signal starts to limit. ("bounce"). Also, replace the White Field with a Resolution chart; and adjust R413 (Y-FOCUS) on the Main Amplifier for best resolution as observed on the b & w monitor. The ND-8 filter at f2 will usually give the best results.

Using the oscilloscope, check the dark current level of the luminance vidicon at TP-1 on the CCU-2 board to make sure that it is less than 50mV peak-to-peak. If not, recheck LIGHTING, subsection 4-4, and ensure 4-7-1(1) adjustments and filter attachments have been correctly performed.

NOTES: a. Because of interaction of controls, repeat the above steps until all conditions are satisfied.

b. If the exact light level is uncertain, an alternative approach is to measure the dark current of the luminance vidicon at TP-1 on CCU-2 by oscilloscope. Adjust R410 (Y-TARGET) on the Main Amplifier for 30–50mV amplitude, as shown in Fig. 4-10 below.

---

*If using a crosshatch generator which can be externally driven, H-drive may be obtained at TP-5 of the CCU-1 board, while V-drive is available at TP-9 of CCU-1.

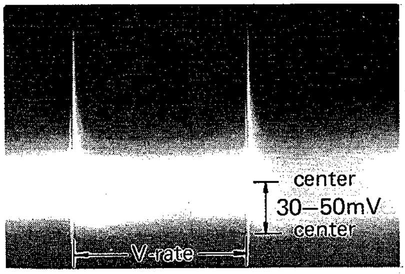


Fig. 4-10

2. Chroma channel
   a. With SSJ-1
   Use the JVC Model No. SSJ-1 Shading/Sensitivity Jig and connect IN jack to output TP-3(CHROMA-IN) on CCU-2 board. With the White Field, Chart No. 2, as the subject, lens at f2 with ND-8 filter, switch at SENSITIVITY position, and scope connected to the output (OUT) of SSJ-1, adjust R409 (C-TARGET) to obtain waveform with amplitude as shown in Fig. 4-11 below:

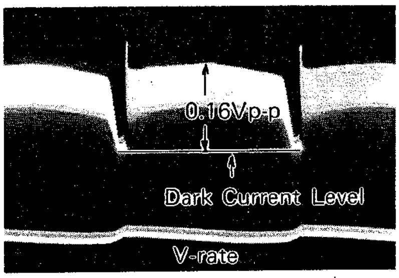
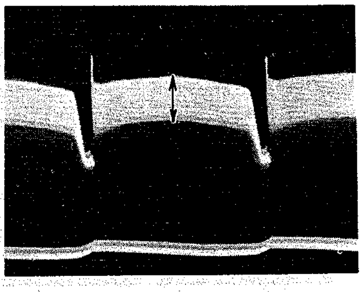


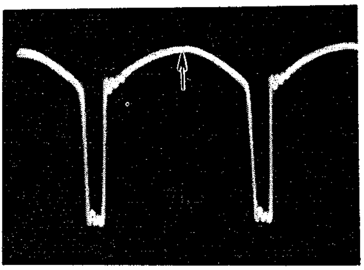
Fig. 4-11

Replace the ND-8 filter with an ND-4; and connect the oscilloscope to TP-3 on CCU-2. Set iris at f2 and adjust R389 (CHROMA BEAM) on the Main Amplifier until the signal starts to distort*. (The chroma is now set to 1.8 times.)

Now turn the iris to f2.8 and adjust R412 (C-FOCUS) located on the Main Amplifier board for maximum signal amplitude at the centers of both the V-rate and H-rate waveforms as shown in Fig. 4-12 below:



(a) V-rate

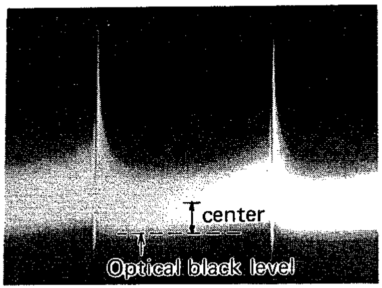


(b) H-rate

Fig. 4-12

NOTE: Because of the interaction of controls, repeat the above steps until all foregoing parameters are met.

b. Without SSJ-1
   The reason for using the SSJ-1 is that the frequency characteristics of the vidicon and preamplifier outputs are not flat. Therefore, the wrong value would be measured, since the jig supplies a low-pass filter which is required for accurate waveform measurement. For best results, SSJ-1 should be utilized. However, if JVC Shading/Sensitivity Jig is not available, proceed as follows:
   1) Close iris and measure the dark-current level at TP-3 on CCU-2.
   2) Adjust R409 (C. TARGET) for a p-p reading of 25–35mV, as shown in Figs. 4-13 and 4-14, following.



(vidicon mask)
V-rate
Fig. 4-13

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*Verify that adjustment is correct by closing iris and then opening slowly until distortion "bounce" occurs, which should be at f2. Readjust if necessary.

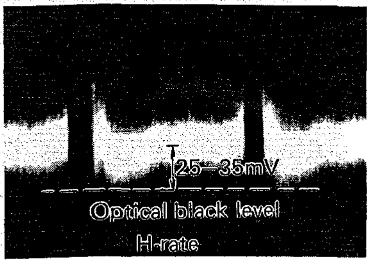
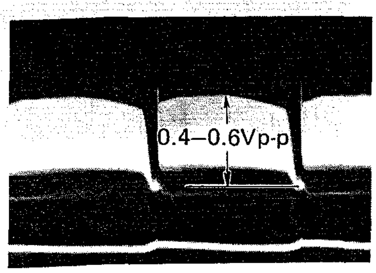


Fig. 4-14

3) The Pre-Amp output, TP-3 on CCU-2, should be about 0.4—0.6Vp-p. See Fig. 4-15 following:



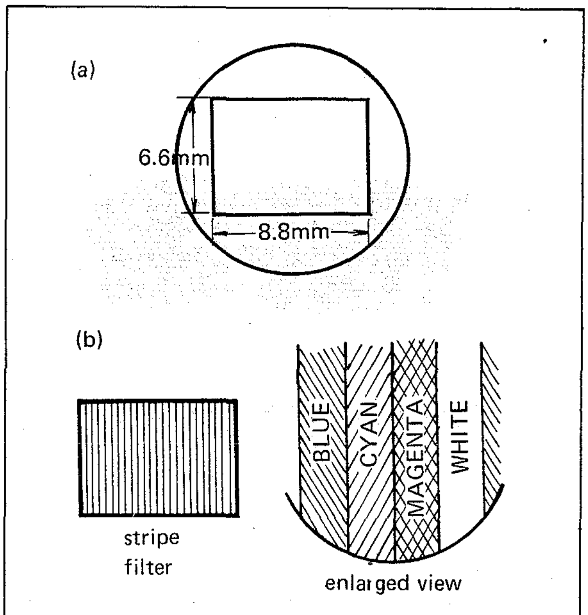
Measure at center of waveform.

Fig. 4-15

4-7-2 Shading Compensation and White Balance

> Although no actual adjustments are indicated in the following Background Information and Preliminary Examples, careful study of this material is essential to the proper performance of the shading compensation and white balance adjustments to follow.

1. Background Information
   a. Scanning adjustments
   Correct adjustment of scanning, both vertically and horizontally, is very important for the achievement of minimal shading. The color stripe filter, which is part of the GC-4800U optical block assembly, is designed to set the scanning size of the chroma vidicon slightly smaller than the 6.6 x 8.8mm (0.26 x 0.35 in.) vidicon active target area. See Fig. 4-16(a). The reason for slight underscanning is to use less of the periphery of the vidicon, which generally has greater shading. See Fig. 4-16.
   In order to accurately set the horizontal scanning size, the 2MHz color carrier, generated by the striped filter (Fig. 4-16(b)) utilized, with the correct setting determined by oscilloscope.



(not to scale – to illustrate principle only)

Fig. 4-16

   Once horizontal scan size has been set, vertical scanning is adjusted to yield the standard 3:4 TV aspect ratio.
   Although scanning adjustments were detailed in the Alignment Procedure, subsection 4-6-1, if there is doubt that the adjustment was properly performed, it should be checked, and repeated if necessary.

   b. Linearity
   Adequate shading compensation also depends upon linearity being within ±2%. The reason for the importance of linearity is that the frequency of the chroma carrier is excessively changed by large linearity errors. The result is that the amplitude of the chroma carrier is changed and causes shading degradation. See Fig. 4-17.
   Subsection 4-6-2, covers linearity adjustments, which are usually NOT necessary unless deflection-related components have been replaced, since linearity is carefully set at the factory. Also, unless a crosshatch generator and linearity chart are available, as specified in the Alignment Procedure, linearity adjustment should NOT be performed.
   c. Beam adjustment, vertical/horizontal alignment, chroma focus
   The adjustment of chroma beam is also quite important to the achievement of shading com-

pensation. Although beam current which is less than recommended may result in somewhat less shading, inability to follow changes in light level and lowering of sensitivity would result, thus increasing the signal-to-noise ratio.

Because beam current may be affected by vertical or horizontal deflection alignment, readjustment is recommended upon V/H realignment, and vice-versa. Also, chroma focus interacts, and therefore, sensitivity, beam, alignment, and chroma focus should be adjusted repeatedly in cyclic manner as indicated in several steps of the shading compensation adjustments which follow.

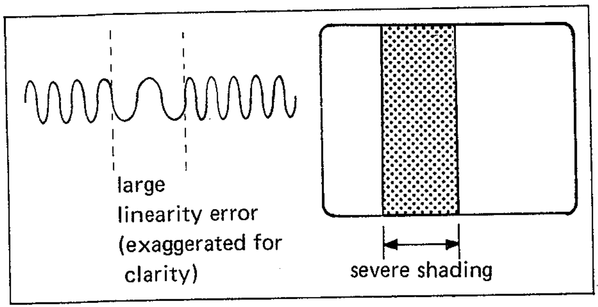


Fig. 4-17

2. Preliminary Examples
   a. Basic nature of shading correction for GC-4800U
   There are two waveforms used in the color portable camera, model GC-4800U: parabola and sawtooth. Since the concept behind shading correction is one of cancellation by addition of another waveform with the same shape, but opposite polarity, errors which have parabolic and saw components may be corrected to form essentially flat waveforms. However, non-parabolic/saw components may not be completely nullified. The objective of shading compensation for the GC-4800U is to reduce the level of shading errors to within 15% of peak white level in the area of the raster 80%-H by 80%-V, centered. Some further tolerance may be permitted near the corners of the 80% rectangle under consideration.
   b. Main purposes of the SSJ-1 for shading correction
   One reason for using the SSJ-1 is that the frequency characteristics of the vidicon and pre-amplifier outputs are not flat. Therefore, the SSJ-1 provides a low-pass filter to assist in obtaining optimal sensitivity setting. Another feature of the jig is gating of the horizontal and vertical waveforms to eliminate the area outside of the 80% rectangle, so that the technician can concentrate of that most critical portion of the signal while making corrective adjustments. This gate may be switched out to view the area outside of the 80% rectangle. Other features include a generated white balance line and connector for NTSC-type output.
   c. Examples of correction methods
   The first kind of correction to make is parabolic. If the original waveform had a symmetrical parabolic shape (ideal case), then parabolic correction would result in the desired flat waveform. See Fig. 4-18. The more usual case of Fig. 4-19 requires saw correction after parabolic compensation. Beam, V/H alignment, and chroma focus may be then readjusted to further reduce shading to an acceptable level.

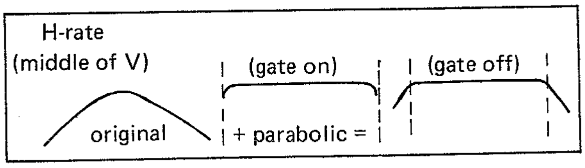


Fig. 4-18

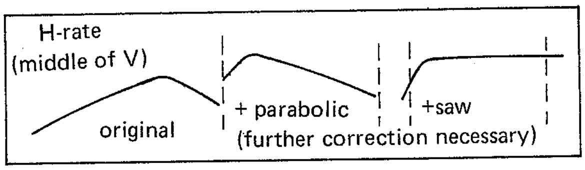


Fig. 4-19

3. Initial adjustments
   a. Connect the oscilloscope to TP-6 (2MHz signal) on CCU-2. With lens at f2, ND-2 and ND-8 attached, White Field, Chart No. 2, as the subject, adjust R422 (C. H. Al) and R423 (C. V. Al) on the Main Amplifier for the most uniformly modulated waveform. See Figs. 4-20, 21.
   b. Adjust R412 (C-FOCUS) on the Main Amplifier for maximum amplitude* of the modulated signal, as shown in the figures below:

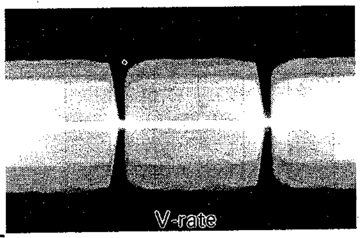


Fig. 4-20*

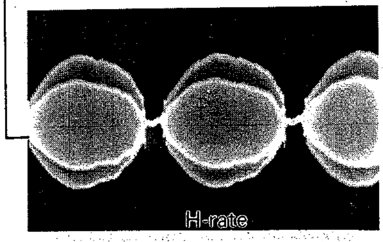


Fig. 4-21

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*The vertical amplitude of each point along the waveform should be near its maximum when R412 has been properly adjusted.

NOTE: The modulated signal should be of sufficient amplitude to adjust shading compensation after this step is completed.

c. If the waveforms of Figs. 4-20 and 4-21 above cannot be obtained by adjustment of R412 (C-FOCUS), repeat the adjustments of step (a), above. Then readjust R412 as in step (b) above.

4-7-3 Static Shading Compensation

1. Without SSJ-1
   Connect the oscilloscope to TP-11, blue output (B), on CCU-2 board. Close the iris and adjust R430 (S. H. PAR.), R433 (S. H. SAW), R451 (S. V. PAR.), and R452 (S. V. SAW) for minimum static shading error.
   Move the scope probe to TP-4, process out, on CCU-2. Keeping the iris closed, adjust R92 (PRE-SETUP) on CCU-2 for zero setup.
   Repeat the static shading adjustments, R430, R433, R451, and R452 as above to further minimize static shading error, until the waveform shown in Fig. 4-22 is obtained.

2. With SSJ-1
   Connect the CH-1 input jack of the SSJ-1 to TP-11, blue output (B) on CCU-2, using one of the two signal cables supplied. With the oscilloscope connected as shown in Fig. 4-1(b), turn the rotary switch of the SSJ-1 to the CH-1 position. Close the lens aperture and adjust R430 (S. H. PAR.), R433 (S. H. SAW), R451 (S. V. PAR.), and R452 (S. V. SAW) for minimum static shading error. Refer to Preliminary Examples and Fig. 4-19 on preceding page for background information.
   Connect channel 2 of the oscilloscope to TP-4, process out, on CCU-2. Keeping the aperture closed, adjust R92 (PRE-SETUP) on CCU-2 for zero setup.
   Repeat the static shading adjustments, R430, R433, R451, and R452 as above to further minimize static shading error, until the waveform shown in Fig. 4-22 is obtained.

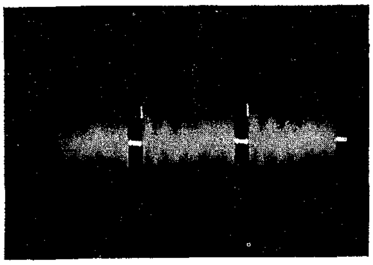
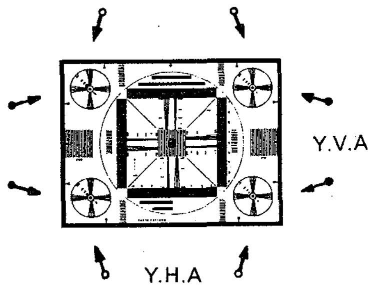


Fig. 4-22

4-7-4 Luminance – final adjustments

1. Focus, horizontal and vertical alignment
   Connect the channel-one probe to TP-2 (Y-OUT) on CCU-2.
   Using both the ND-2 and ND-8 filters together, with the iris set at f2, observe the signal on the b & w monitor.
   With the resolution chart as subject, adjust R418, Y-channel horizontal alignment (Y. H. A.), R419, Y-channel vertical alignment (Y. V. A.), and R413 (Y-FOCUS) for optimal uniformity and resolution as indicated by Fig. 4-23, below:



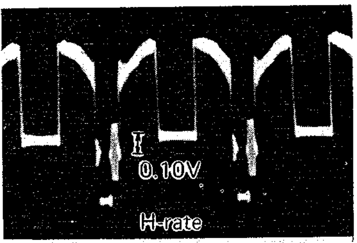
R413 (Y-FOCUS):	Adjust the center of the picture for best resolution possible.
R419 (Y.V.A.) :	Adjust the focus at the top and bottom of the raster to obtain the optimal setting.
R418 (Y.H.A.) :	Adjust for optimal focus at the left and right sides of the picture.

Fig. 4-23

After the vertical and horizontal alignment adjustments, readjust the Y-FOCUS to obtain the following specifications:

- At the center – more than 400 lines.
- At the corners – more than 300 lines.

2. Set-up level
   Attach the ND-8 filter and set the lens iris to f2. Use the Set-up pattern, Test Chart No. 3 (APL 90%). Connect oscilloscope to TP-13 on CCU-1. Adjust R31 (Y-SETUP) on CCU-2 for a pedestal of 0.10 volts p-p. See Fig. 4-24.



NTSC-type output signal
Fig. 4-24

3. Video level
Replace the Set-up pattern with the Video Level pattern, Chart No. 4 (APL 50%). With oscilloscope at TP-13 on CCU-1, adjust R15 (Y-Gain) on CCU-2 for a video level of 0.62V p-p. See Fig. 4-25.

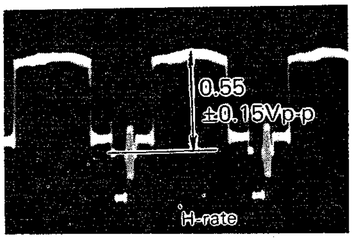
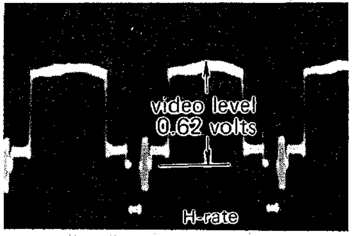


Fig. 4-25

4. AGC level check
Still using the Video Level/AGC pattern, Chart No. 4, attach both the ND-8 and ND-2 filters to the lens. Observe TP-13 on CCU-1 with oscilloscope. Now check the video level to verify proper AGC action, referring to Fig. 4-26.



NTSC-type output signal
Fig. 4-26

5. White clip level adjustment
Replace the Video Level/AGC pattern with the Clip Level pattern, Chart No. 5 (20% APL). Attach the ND-4 filter to the lens, set to f2. Observe TP-13 on CCU-1 with oscilloscope. Then, if necessary, adjust R41, white clip, on CCU-2 for a video level (from blanking level to white clip level) of 0.65–0.70Vp-p, by removing the CCU-2 P.C. board (four screws).

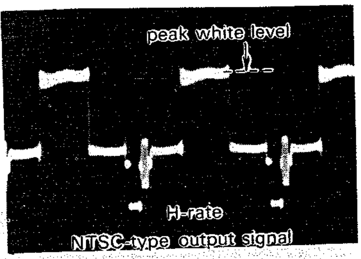


Fig. 4-27

NOTE: The above adjustment affects the chroma channel's white clip level at the same time. Therefore, white clip is completed for both luminance and chrominance by the adjustment of R41.

4-7-5 Red and Green Balance

1. Use the White Field pattern, Chart No. 2. Attach both the ND-2 and ND-8 filters to the lens and set the aperture to f2.
2. Connect the oscilloscope to TP-5 (low output) on CCU-2 and measure the value.
3. With the scope probe at TP-7 (2MHz output) on CCU-2 and the White Field, Test Chart No. 2, remaining as the subject, adjust R132 (G BALANCE) on CCU-2 for the same value as that measured at TP-5, in the previous step.
4. With the probe at TP-8 (1MHz output) on CCU-2, adjust R168 (R BALANCE) on CCU-2 for 1.5 times the value of TP-5, as previously measured.

EXPLANATORY NOTE:
In steps 1—4 above, red and green balance was adjusted in order to normalize the matrix-input ratio of red and green signals after detection (see Overall Block Diagram, Section 7-1). The proper ratio is important to ensure correct matrix functioning.
The following subsection 4-7-6 will detail set-up and gain adjustments necessary in order to prepare the R, G, B signals to be accurately combined into (R—Y) and (B—Y) difference vectors for driving the balanced modulator. Since shading correction may affect the relative amplitude of the color components, re-balancing is indicated at various points in the subsection following.

4-7-6 Dynamic Shading and White Balance

1. Without SSJ-1

a. Connect the oscilloscope to TP-11, blue output (B), on CCU-2. Close the lens aperture (C) and adjust R32 (B-SETUP) on CCU-2 for a p-p signal of 0.1 volts. See Fig. 4-28.

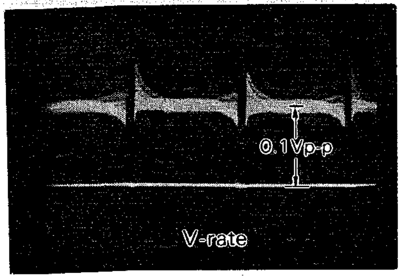


Fig. 4-28

b. Connect the scope probe to TP-13, NTSC-type output (V. S. OUT) on CCU-1 board. Adjust R122 and R154, carrier balance (C-BAL), on CCU-1 for minimum carrier leakage in vertical blanking. See Fig. 4-29.

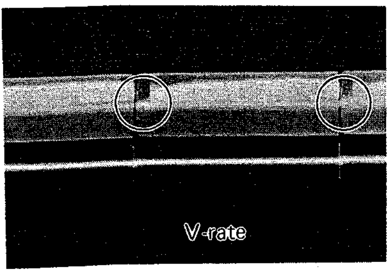


Fig. 4-29

c. With the scope on TP-13, adjust R33 (G-SETUP) and R34 (R-SETUP) for minimum carrier leakage in the signal. See Fig. 4-30.

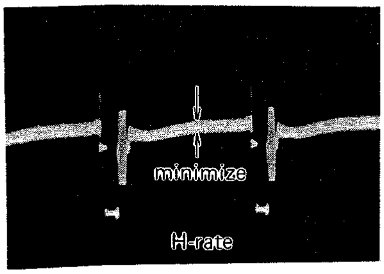


Fig. 4-30

d. Connect the scope probe to TP-11, blue output (B), on CCU-2. Use the White Field pattern, Chart No.2. Set the lens iris to f2 and attach ND-2 and ND-8 filters. Adjust R115 (B-GAIN) on CCU-2 for the level indicated by Fig. 4-31.

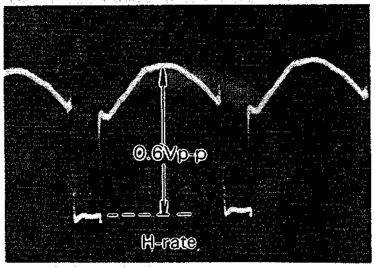
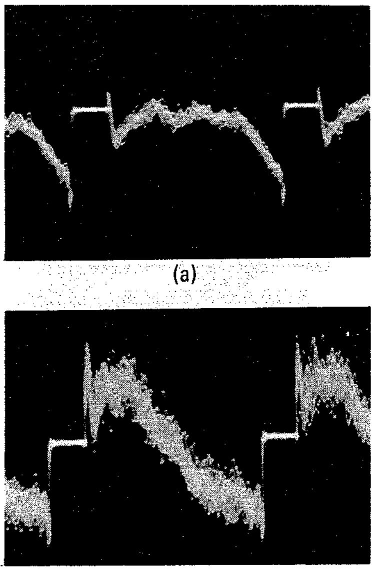


Fig. 4-31

e. Connect the channel-one probe to TP-10, green output (G), and the channel-two probe to TP-11, blue output (B), both on CCU-2. Adjust both channels of the scope to the same range and invert one channel. Place the oscilloscope in the ADD mode, setting at 0.1V/div.
With both ND-2 and ND-8 filters still attached and lens aperture at f2. Continue using the White Field, Chart No. 2. Adjust R156 (G-GAIN) to the same level as the blue output. See Fig. 4-32, (a) and (b), for examples of two types of possible waveforms.



(a)

(b)

NOTE: Keep the same level for the blanking and the middle of the waveform.

Fig. 4-32

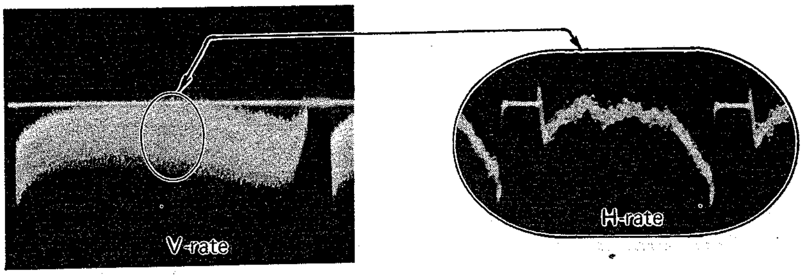


Fig. 4-33

Move the channel-one probe to TP-9, red output(R) and adjust R197 (R-GAIN) for the same level as the blue output, as shown by Fig. 4-32.

f. Adjustment of dynamic shading correction waveforms
   1) Connect the channel-one probe to TP-10 and the channel-two probe to TP-11, both on CCU-2, as in step (e), preceding. If there were no shading, the waveforms would be flat, without parabolic or saw components. Shown in Fig. 4-33 is a simplified example, before correction.

      NOTE: For the waveforms below, the oscilloscope should be locked by V.D. (TP-9 of CCU-1), and be in delayed sweep mode. Select the H-rate waveform from the center of the V-rate waveform. This H-rate center waveform will be corrected in step (2) below.

      The goal of shading compensation is to match each waveform (R, G. B) to each other, so that the proportion of each color's contribution to the NTSC-type output is constant over the entire raster. In practice, shading differences cannot be entirely eliminated, but can be minimized. The specification for GC-4800U shading is 15% within the central 80% of the height and width of the raster.
      If sensitivity has been set even slightly too high, then beam current will be too large and dynamic shading may be severe. Therefore, if difficulties occur when making the following dynamic shading adjustments, recheck subsection 4-7-1, and then repeat the adjustments.

   2) Dynamic horizontal (D.H.) shading compensation
      i) Use the D.H. shading compensation potentiometers (R431, D.H. PAR.; R432, D.H. SAW) to adjust only the 80%-H central portion of the H-rate waveform. The primary objective of the various adjustments is to obtain the essentially flat waveform of Fig. 4-34. However, note that although overcompensation, as illustrated in the figure, may indeed produce less shading outside the mid-central area; the mid-central area is much more significant visually, and flatness is quite critical there. Therefore, flatness may be sacrificed in the edges of the 80%-H region to achieve freedom from shading in the center. Correct only H-rate waveform in center of V.
      ii) After adjustment of D.H. shading, if waveform balance is lost, the red and green balance should be readjusted with G BALANCE (R132) and R BALANCE (R168), both on CCU-2, with probes at positions indicated by 4-7-6(e).

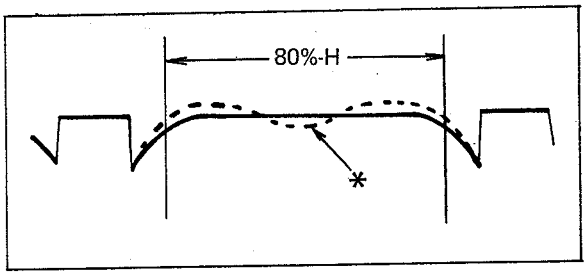


Fig. 4-34**

---

*overcompensation by parabolic waveform

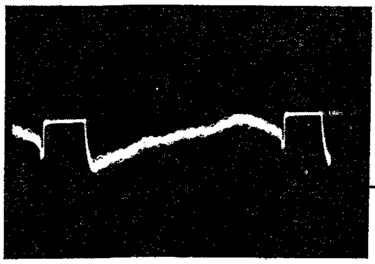
** H-rate waveform selected from center of V-rate in step 1) above.

3) Basic adjustment sequence for D. H. shading compensation*

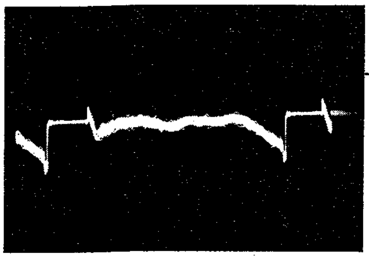
ADJUSTMENT		POT./LOCATION	T.P./LOCATION
(a)	H. Alignment (Chroma)	R422/Main Amp	TP-6/CCU-2
(b)	C. Focus	R412/Main Amp	TP-6/CCU-2
(c)	D.H. Shading Comp.	R432, R431/Main Amp	Ref. 4-7-6, f-(1),(2) P.4-13
(d)	Red and Green Balance	R132, R168/CCU-2	Ref. 4-7-5
(e)	V. Alignment (Chroma)	R423/Main Amp	TP-6/CCU-2
(f)	C. Focus	R412/Main Amp	TP-6/CCU-2
(g)	H. Alignment (Chroma)	R422/Main Amp	TP-6/CCU-2
(h)	C. Focus	R412/Main Amp	TP-6/CCU-2
(j)	H. Alignment (Chroma)	R422/Main Amp	TP-6/CCU-2

4) Dynamic vertical (D.V.) shading compensation

i) Observing the H-rate waveform with the scope probes still at TP-10 and TP-11 of CCU-2, and one channel inverted, as in the previous steps 1) and 2), readjust R412(C-FOCUS) on the Main Amplifier for maximum amplitude** as in 4-7-2, 3. Also, readjust R422 (C. H. Al) for a symmetrical waveform, as shown in Fig. 4-35. (Whenever either horizontal or vertical alignment is adjusted, chroma focus must be readjusted.) Adjust R412 (C-FOCUS) again. Readjust red and green balance (referring to 4-7-5).



BEFORE



AFTER

Fig. 4-35

ii) Viewing the V-rate waveform, with the oscilloscope probes as in step i) above, adjust R423, chroma vertical alignment (C.V.Al) and R422, chroma horizontal alignment (C. H. Al), both on the Main Amplifier board, in order to approach the Ideally Corrected waveform of Fig. 4-36.

iii) Readjust D.H. shading compensation according to the previous steps 2) in order to attain an H-rate waveform which more nearly resembles waveform (b) of Fig. 4-36.

iv) Repeat steps ii) and iii) above, until the waveforms of Fig. 4-36 have been approached as closely as possible, including (a) and (c).

v) Finally, using the D.V. shading compensation potentiometers R450 (D.V. PAR.); R453 (D. V. SAW) adjust in order to achieve very closely the idealized waveforms of Fig. 4-36.

5) Correct adjustment of dynamic shading, because of the interaction of controls, usually requires several repetitions of the adjustment sequence of steps 1)—4) above before satisfactory results are obtained.

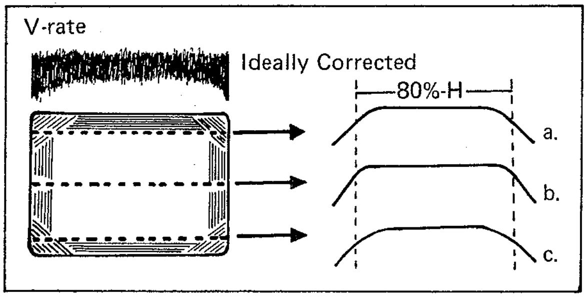


Fig. 4-36

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*arrows show loops to be repeated until acceptable level of performance is achieved.

**TP-6 of CCU-2 board

2. With SSJ-1

a. Connect the CH-1 input jack of the SSJ-1 to TP-11, blue output (B), on CCU-2, using one of the two signal cables supplied. Connect the CH-2 input jack to TP-10, green output (G), on CCU-2, with the other supplied signal cable. With the scope connected to the Shading/Sensitivity Jig as shown in Fig. 4-1(b), turn the rotary mode switch of SSJ-1 to the CH-1 position.

Close the lens aperture (C) and adjust R32 (B-SETUP) on CCU-2 for a p-p signal of 0.1 volts. See Fig. 4-37.

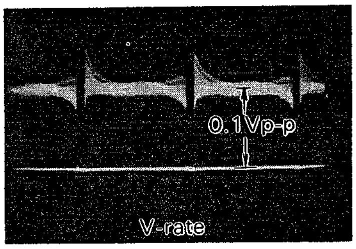


Fig. 4-37

b. With the VIDEO IN and VIDEO OUT connectors of the SSJ-1 linked to the GA-20U and color monitor, respectively, as shown in Fig. 4-1(b), turn the SSJ-1 mode switch to the VIDEO position to observe the NTSC-type output (V. S. OUT on CCU-1 board). Adjust R122 and R154, carrier balance (C-BAL), on CCU-1 for minimum carrier leakage in vertical blanking. See Fig. 4-38.

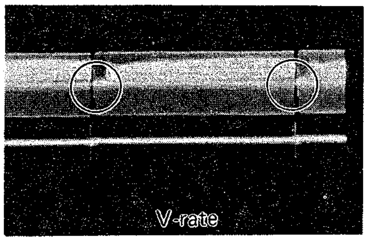


Fig. 4-38

c. Leaving the mode switch in the VIDEO position, adjust R33 (G-SETUP) and R34 (R-SETUP), both on CCU-2, for minimum carrier leakage in the signal. See Fig. 4-39.

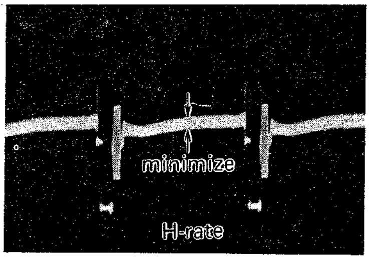


Fig. 4-39

d. Changing the mode switch to the CH-1 position to monitor the blue output of CCU-2, use the White Field, Chart No. 2, with the lens aperture set to f2 and both ND-2 and ND-8 filters attached. Adjust R115(B-GAIN) for the level indicated by Fig. 4-40.

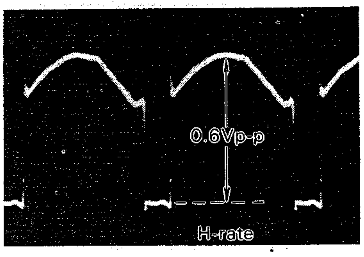


Fig. 4-40

e. With the blue and green outputs of CCU-2 still connected to CH-1 and CH-2, respectively, of SSJ-1, place the mode switch in the SHADING/W-BAL position. Adjust the oscilloscope connected to SSJ-1 to the 0.1V/div range, still using the White Field chart and lens at f2 with both ND-2 and ND-8 filters attached. Turn SSJ-1 toggle switch to GATE ON position.

In the SHADING/W-BAL mode, the signal input to CH-1 is electronically subtracted from the input to CH-2. In the present case, the resultant output to the oscilloscope is thus (G—B), green minus blue. With reference to Fig. 4-41 and Fig. 4-42, adjust R156 (G-GAIN) to the same level as the blue output.

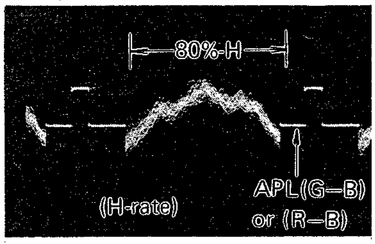


Fig. 4-41 Unbalanced

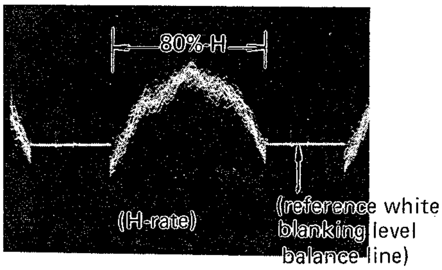


Fig. 4-42 Balanced

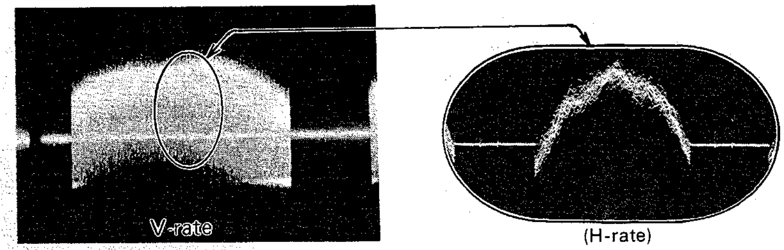


Fig. 4-43

Change the connection of the clip of the signal cable attached to input of SSJ-1 to the red output (R), TP-9. Now, the oscilloscope display will show (R—B). Adjust R197 (R-GAIN) for the same level as the blue output, with reference to Figs. 4-41 and 4-42.

f. Adjustment of dynamic shading correction waveforms

1) With SSJ-1 CH-1 input to TP-11, and CH-2 input to TP-10 as in the preceding step, and SSJ-1 in SHADING/W-BAL mode, place the oscilloscope in the delayed-sweep mode (connected and triggered as shown in Fig. 4-1(b), and select the H-rate waveform from the center of the V-rate waveform as shown in Fig. 4-43.

   The goal of shading compensation is to match each waveform (R, G, B) to each other, so that the proportion of each color's contribution to the NTSC-type output is constant over the entire raster. In practice, shading differences cannot be entirely eliminated, but can be minimized. The specification for GC-4800U shading is 15% within the central 80% of the height and width of the raster.

   If sensitivity has been set even slightly too high, then beam current will be too large and dynamic shading may be severe. Therefore, if difficulties occur when making the following dynamic shading adjustments, recheck subsection 4-7-1.

NOTE: For the dynamic horizontal and vertical shading compensation following, white re-balancing is usually necessary.
White balance may be easily checked by turning the GATE switch of the SSJ-1 to the ON position, while observing the white balance line generated in the blanking interval.

2) Dynamic horizontal (D.H.) shading compensation

   i) Use the D.H. shading compensation potentiometers (R431, D.H. PAR.; R432, D.H. SAW) to adjust only the 80%-H central portion of the H-rate waveform. The primary objective of the various adjustments is to obtain the essentially flat waveform of Fig. 4-44. However, note that although overcompensation, as illustrated in Fig. 4-44 may indeed produce less shading outside the mid-central area; the mid-central area is much more significant visually, and flatness is quite critical there. Therefore, flatness may be sacrificed in the edges of the 80%-H region to achieve freedom from shading in the center. Correct only H-rate waveform in center of V.

   ii) After adjustment of D.H. shading, if waveform balance is lost, the red and green balance should be readjusted with G BALANCE (R132) and R BALANCE (R168), both on CCU-2, as in Alignment Procedure subsection 4-7-5. The objective is to recover the original waveform of Fig. 4-44.

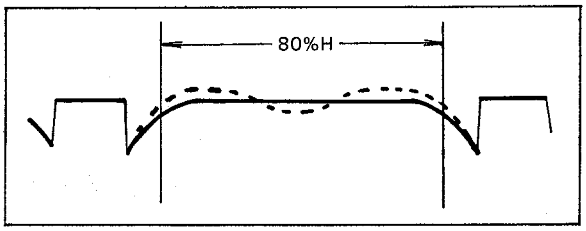


Fig. 4-44

FIGURE NOTES:

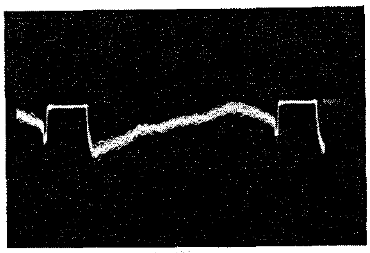
- Waveform is H-rate, selected from center of V-rate in step f-1) above.
- Dip in dashed waveform shows overcompensation by D.H. PAR.

3) Basic adjustment sequence for D.H. shading compensation*

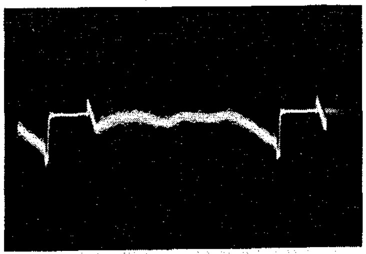
(a)	H. Alignment (Chroma)	R422; Main Amp.	TP-6; CCU-2
(b)	C. Focus	R412; Main Amp	TP-6; CCU-2
(c)	D. H. Shading Comp.	R432; R431; Main Amp	Ref: Step f-(1),(2), p.4-16
(d)	Red and Green Balance	R132, R168; CCU-2	Ref: 4-7-5
(e)	V. Alignment (Chroma)	R423; Main Amp	TP-6; CCU-2
(f)	C. Focus	R412; Main Amp	TP-6; CCU-2
(g)	H. Alignment (Chroma)	R422; Main Amp	TP-6; CCU-2
(h)	C. Focus	R412; Main Amp	TP-6; CCU-2
(j)	Check with GATE OFF	GATE; SSJ-1	TP-6; CCU-2
(k)	H. Alignment (Chroma)	R422; Main Amp	TP-6; CCU-2

4) Dynamic vertical (D.V.) shading compensation

i) Observing the H-rate waveform with the SSJ-1 CH-1, CH-2 inputs to TP-10 and TP-11 of CCU-2, respectively, use SHADING/W-BAL mode. Using Alignment Procedure, re-adjust R412 (C-FOCUS) on the Main Amplifier for maximum amplitude** as in 4-7-2, 3. Also, readjust R422 (C.H. Al) for a symmetrical waveform, as shown in Fig. 4-45. (Whenever either horizontal or vertical alignment is adjusted, chroma focus must be re-adjusted.) Adjust R412 (C-FOCUS) again. Readjust red and green balance (referring to Alignment Procedure subsection 4-7-5).



BEFORE



AFTER

Fig. 4-45

ii) Viewing the V-rate waveform, with the SSJ-1 signal cable inputs as in step i) above, adjust R423, chroma vertical alignment (C. V. Al) and R422, chroma horizontal alignment (C. H. Al), both on the Main Amplifier board, in order to approach the Ideally Corrected waveform of Fig. 4-46.

iii) Readjust D. H. shading compensation according to the previous steps (2, i—ii) in order to attain an H-rate waveform which more nearly resembles waveform 2 of Fig. 4-46.

iv) Repeat steps ii) and iii) above, until the waveform of Fig. 4-46 have been approached as closely as possible, including 1 and 3 .

v) Finally, using the D.V. shading compensation potentiometers (R450, D.V. PAR.; R453, D. V. SAW) adjust in order to achieve very closely the idealized waveforms of Fig. 4-46.

5) Correct adjustment of dynamic shading, because of the interaction of controls, usually requires several repetitions of the adjustment sequence of steps (1—4) above before satisfactory results are obtained.

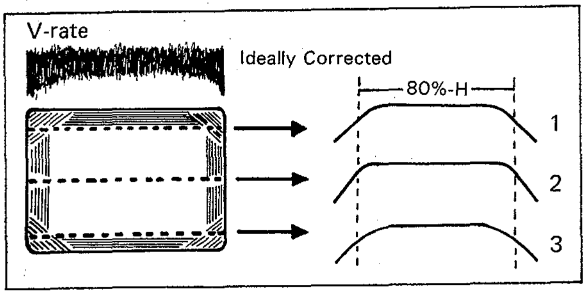


Fig. 4-46

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* arrows show loops to be repeated until acceptable level of performance is achieved.

**TP-6 of CCU-2 board connected to channel 2 of oscilloscope.

4-7-7 Final Fine Adjustment

1. Check the optical black level, with reference to 4-6-1(5).
2. Check the static shading and adjust the preset. See 4-7-3.
3. Adjust the chroma set-up. Refer to 4-7-6 (1, a–c, Without SSJ-1 or 4-7-6(2, a–c, With SSJ-1)
4. Check the blue gain 4-7-6, (1-d, Without SSJ-1) or 4-7-6(2-d, With SSJ-1), and the red and green balance (4-7-5).
5. Connect the oscilloscope to TP-13, NTSC-type output (V.S. OUT) on the CCU-1 board. Attach both the ND-2 and ND-8 filters to the lens and set the iris to f2. Using the White Field, Chart No.2, as the subject, adjust R156 (G-GAIN) and R197 (R-GAIN) for minimum carrier leak in white. See Fig. 4-47.

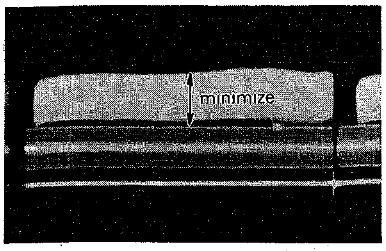

Fig. 4-47

4-7-8 Automatic Saturation Control (ASC) Adjustment

1. Connect the oscilloscope to TP-3 (CHROMA IN) on the CCU-2 board. Use the ASC, 50% APL pattern, Test Chart No. 6, as the subject, and the ND-8 filter attached to the lens. Set the lens iris to f2. Read the peak-to-peak voltage of the signal as shown in Fig. 4-48 below:

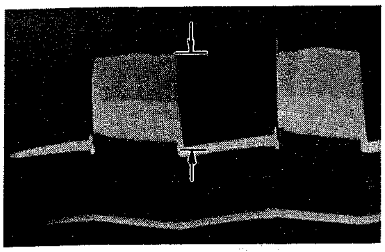

Fig. 4-48

2. Remove the ND-8 filter and replace with the ND-2. Now adjust R702 (ASC), located on the ASC printed circuit board until the p-p voltage is the same as it was when the ND-8 filter was used.
3. Recheck the preset adjustment, with reference to 4-7-3.
4. Readjust the white balance, according to the procedure below:
   a. Connect the oscilloscope to TP-9, red output(R), on CCU-2. Remove the ND-2 and attach only the ND-8 filter to the lens. Use Chart No. 2.
   b. Set the iris to f2.8 and observe the amplitude of the red output at TP-9, which should be about 0.6 volts from the previous adjustments, 4-7-6, (1, d–e, Without SSJ-1) or 4-7-6 (2, d–e, With SSJ-1). Now, slowly open the iris toward f2, but stop if 0.65 volts can be obtained at TP-9. Otherwise, use f2 setting of lens.
   c. Observe the NTSC-type output at TP-13 (V.S. OUT) on the CCU-1 board. Now, adjust R156 (G-GAIN) and R115 (B-GAIN) to achieve minimum carrier leakage in white. Refer to Fig. 4-47.

4-7-9 Registration

1. Remove the ND-2 filter, and replace with the ND-8. Use the appropriate f-stop and the C/Y Registration pattern, Chart No. 1, observing the signal on the oscilloscope connected to TP-13, NTSC-type output (V.S. OUT) on CCU-1, and also on the color monitor. The monitor should only be used as a rough guide in registration; main reliance should be placed on the oscilloscope waveform. For horizontal registration, select a line* slightly above or below the central horizontal red crossbar of Chart No. 1, as shown in Fig. 4-49 below:

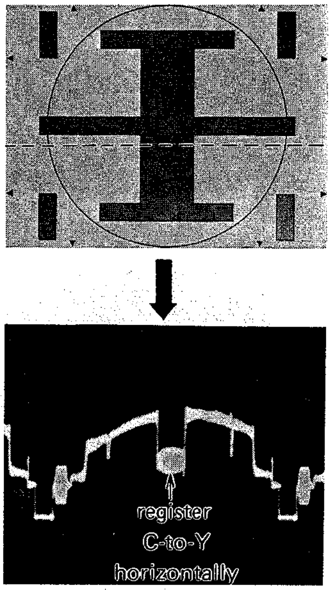

Fig. 4-49

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*Use the delay mode of the oscilloscope.

2. If any misregistration is evident, adjust L304* (H.Y. SUB WIDTH), R315 (H.Y. CENT.), R373(V. Y. CENT.), R376 (V. SUB HEIGHT), and R340 (SKEW), all located on the Main Amplifier board in the camera head. See Fig. 4-49 waveform.

4-7-10 Checking and Adjustment of the Optical System

The following item A, including chroma/luminance registration and C-Y optical path length adjustments, is to be used for Y-vidicon replacement. For replacement of C-vidicon, either separately or together with Y-tube, follow item B first, and then item A. For either C or Y, selected vidicon type 20PE14C is required for best performance.

A. Luminance vidicon replacement

1. Checking for dust and flaws
   a. For Y-vidicon, connect the oscilloscope probe to TP-1 (Y-IN) on the CCU-2 board and observe the black-and-white monitor. For chroma vidicon, connect the oscilloscope to TP-3 (CHROMA-IN) in CCU-2 and observe the black-and-white monitor.
   b. With the White Field, Chart No. 2, as the subject, zoom to close-up. Set iris initially to f 8. If no luminance output appears, adjust R413 (Y-FOCUS) on the Main Amplifier board.
   c. If the image of dust exists on the picture, wipe the vidicon surface clean again.

   NOTE: If a white or gray spot is observed placing the lens iris in the closed position, there is a flaw on the vidicon surface.
2. Coarse adjustment for registration
   a. Using the C/Y Registration pattern, Chart No.1, as the subject, set the iris at f 5.6 and observe the signal on the color TV monitor.
   b. If mis-registration of the chroma tube and the Y-tube exists, loosen the three screws located as shown in Fig. 3-17 (Section 3) which secure the prism assembly.
   c. Move the prism assembly until the registration error of the chroma tube and Y-tube is at a minimum. Be especially careful to eliminate all rotational error, if possible, and to minimize lateral errors at the same time. See Fig. 4-50. Then tighten the three prism assembly fastening screws.
   d. Adjust R373 (V.Y.CENT.) and R315 (H. Y. CENT.) on the Main Amplifier to properly register the picture on the color TV monitor.
   e. Check for residual rotational mis-registration as shown in Fig. 4-50. If rotational mis-registration exists, perform the following adjustment.

   NOTE: Also, check that R373 and R315 still have room for adjustment even if no rotational mis-registration exists. Perform the following adjustment, nevertheless.

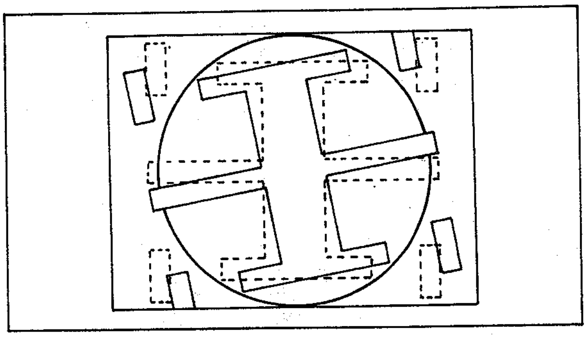

Fig. 4-50

3. Optical path-length adjustment
   a. Using the C/Y Registration pattern, Chart No.1, as the subject, set the iris at f 2, with ND-8 filter attached, and observe the signal on the color TV monitor.
   b. The purpose of optical path-length adjustment is to equalize the length of the path from the dihedral of the prism to both the luminance and chrominance vidicons. Refer to Fig. 4-51.

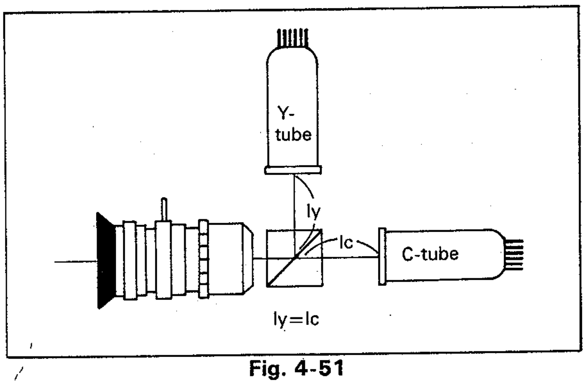

Fig. 4-51

   c. Set the potentiometers, R373 (V. Y. CENT.) and R315 (H. Y. CENT.) on the Main Amplifier board so as to purposely misregister the "Y-to-C" image as shown in Fig. 4-52.

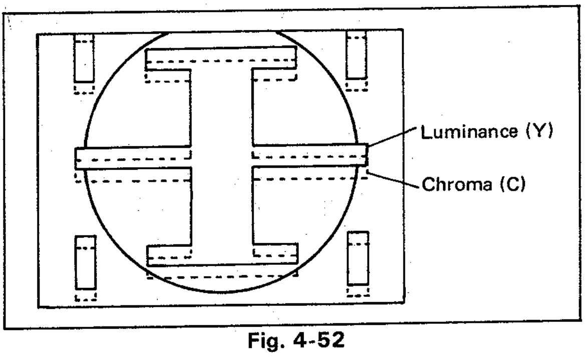

Fig. 4-52

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*Use adjustment screwdriver modified as per 4-6-1(7).

d. While watching the monitor, slowly adjust lens focus until chroma image is sharpest. Now, readjust focus until luminance image is sharpest. Check if there is any difference between the best-focus points for Y and C. (It may help to mark setting in pencil on lens barrel.) If there is a difference follow steps, e, f, g, below.

e. Loosen the four screws slightly which secure the vidicon plate (Y).

f. Rotate the adjusting ring (Y) so as to obtain the best focus at the same point as step (b) above. See Fig. 4-53.

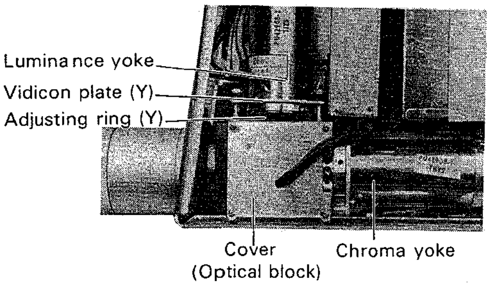


Fig. 4-53

g. Fasten the four screws after recheck steps (a)—(d).

NOTE: 1) Focus seldom needs readjustment in case of Y-tube replacement, except when the vidicon tube along with its base is not installed fully into the yoke.

2) Be sure to recheck registration and rotation after focus adjustment, following (4) below.

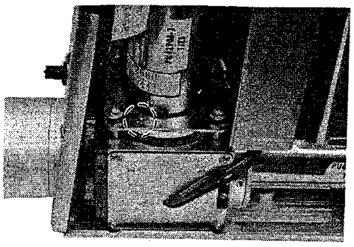
4. Adjustment for rotation

The following steps should be performed only if rotational or optical path-length errors remain. Use C/Y Registration pattern, Chart No. 2, with lens set f 2.

a. Set the potentiometers, R373 (V. Y. CENT.) and R315 (H.Y.CENT.) on Main Amplifier, respectively, in the center position.

b. Loosen the four screws which secure the (Y) vidicon plate.

c. Move the pin of the vidicon clamp located in the hole of the vidicon plate by using regular screwdriver so that rotational mis-registration is at a minimum on the color TV monitor. See Fig. 4-54.



d. If the rotation error is still observed after the above adjustment, set the pin of the vidicon clamp in the center of the hole and perform the following adjustment.

e. After loosening the three setscrews of the vidicon clamp. See Fig. 4-55. Rotate the deflection yoke and adjust for correction of rotational registration errors, while observing the color monitor.

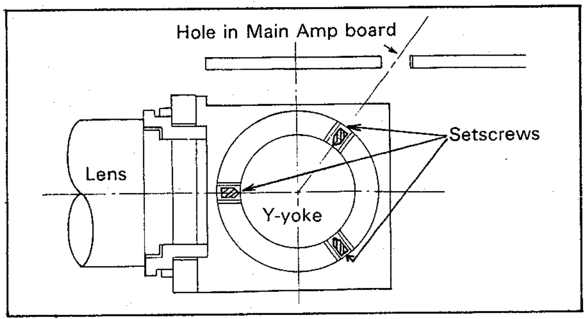


Fig. 4-55 Top view (cross section)

f. Moderately tighten (to prevent yoke damage) the three setscrews when the images from the Y-tube and chroma tube are rotationally registered. (Fine adjustment of rotation can be performed by inserting a metric hex wrench into the vidicon clamp assembly setscrews, accessing one of them through the cut-out in the Main Amplifier board, and then rotating the vidicon clamp clockwise or counterclockwise.)

g. Fasten the four cross-head screws to fasten the yoke assembly to the optical block.

h. If necessary, readjust the registration as described above; and recheck tightness of the three setscrews.

5. Scanning adjustments

Refer to subsection 4-6-1 (all steps, but with particular care on step 5).

NOTE: Check PRE-SETUP, R92 on CCU-2 board for zero setup, viewing waveform of TP-4, process out, on oscilloscope. Re-adjust if necessary.

6. Sensitivity/beam, Luminance final adjustment, and Registration

a. Sensitivity/beam — Refer to subsection 4-7-1.

b. Luminance final adjustment — Refer to subsection 4-7-4.

c. Registration — Refer to subsection 4-7-9.

7. Back focus adjustment — See subsection 4-7-11, following.

B. Chroma vidicon replacement

1. Checking for dust and flaws

Refer to "Luminance vidicon replacement", subsection 4-7-10, A(1) and follow the same procedure.

2. Optical mask adjustment

Use the White Field pattern, Chart No. 2 with lens set to f 2. Observe the image of the vidicon screen mask on the color monitor while positioning the adjustment screw to cause the mask to be horizontal. When the correct position is reached, moderately tighten (to prevent deformation) the adjustment screw. Also, moderately tighten the two setscrews located on each side of the adjustment screw.

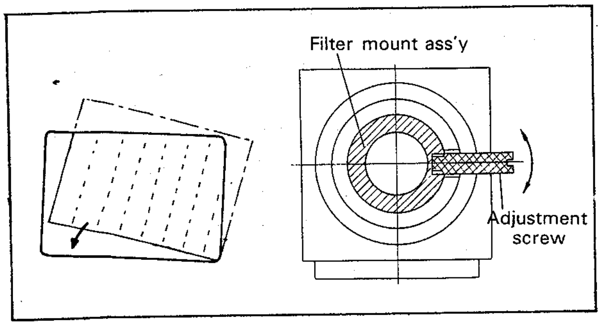


Fig. 4-56

3. Lenticular/stripe filter adjustment
   Use an unmodified Fuller No.301 or equivalent (see Equipment Required, subsection 4-2-1) screwdriver, or equivalent, covering the blade fully with heat-shrink tubing. With the White Field pattern as subject and lens set to exactly f2, use an oscilloscope to observe the 2MHz color carrier signal at TP-6 of CCU-2.
   a. Loosen the adjustment screw. Use the heat-shrink covered screwdriver as a lever to turn the slotted chroma adjusting ring, which sets the distance between the lenticular/stripe filter and the chroma vidicon. See Fig. 4-57. Be very careful not to disturb the optical elements.

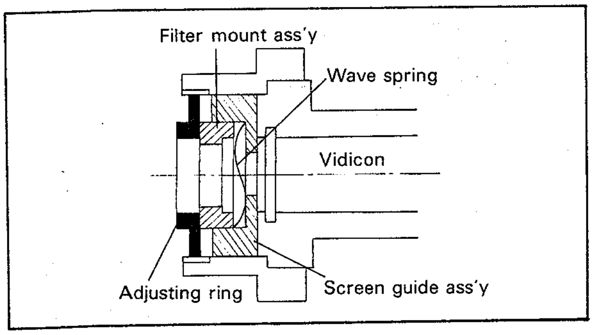


Fig. 4-57 (cross section)

   b. With aperture of lens set at f8, loosen the slotted ring. Observe that the 2MHz color carrier signal at TP-6 of CCU-2 increases in level until color carrier is easily visible on oscilloscope screen. If output is not easily seen, electrical focus may be improperly set. Adjust R412 (C-FOCUS) located on the Main Amplifier, until 2MHz output becomes visible. If there is still no output, perform addition adjustments of subsection 4-7-1 until color carrier output at TP-6 of CCU-2 is easily visible.
   c. With the oscilloscope probe still at TP-6 (2MHz signal) on CCU-2 board, adjust R336 (H. WIDTH), located on the Main Amplifier board in the camera head, for maximum signal amplitude at the center of the H-rate signal waveform. There are two points within R336's range which yield maximum amplitude; the one which provides the widest image on the monitor is the correct point.
   d. Repeat step (a), above, to optimize level of 2MHz color carrier. Next, repeat step (b), above, BUT WITH LENS AT f2 AND ND-8 FILTER attached. Then perform step (c) again. The cycle of steps (a), (b), (c) should be performed until the 2MHz color carrier signal is maximized.

For remainder of procedure, C/Y registration, optical path and back-focus, refer to item (A) at the beginning of this subsection (4-7-10).

4. Scanning adjustment
   Perform the scanning adjust according to subsection 4-6-1, 1–6.
5. Fine adjustment of optical focus
   a. Connect the oscilloscope probe to TP-6 (2MHz signal) on the CCU-2 board. Attach an ND-8 filter to the lens and set the iris to f2. Using the White Field, Chart No. 2, as the subject, and zoom to close-up.
   b. Optical focus should now be finely adjusted, referring to Figs. 4-20, 21 (which are used also for electrical focus adjustment). The H-rate waveform should be maximized as shown in Fig. 4-21. The V-rate waveform should be relatively flat.
   c. Tighten the adjustment screw, and check that the amplitude of the 2MHz signal does not changed and the chroma tube does not shift. (Since tightening of the adjusting ring may cause a small shift in the level of the 2MHz color carrier, compensation should be made by slightly mis-setting in the opposite direction before tightening. Also, ensure that H-rate waveform is as shown in Figs. 4-20, 21, without ringing. Readjust for parallel placement of lenticular filter if ringing is present on the waveform envelope). Now, securely tighten the two setscrews located on each side of the adjustment screw.
6. Adjustment for registration
   a. Attach an ND-8 filter to the lens and set the iris to f5.6.
   b. Using the C/Y Registration pattern, Chart No. 1, as the subject, register the picture on the color TV monitor by adjusting the location of the prism.
   c. Secure the three screws.
   d. Perform the adjustment according to subsection 4-6-1, 7.

7. Other check items
   a. Rotational mis-registration
   b. Y focus
   c. Flange-back (back focus) adjustment
   d. Overall alignment

4-7-11 Flange-back (back focus) adjustment

Use the Back-Focus Wrench Set, PUJ40543/PUJ40544, which consists of two wrenches, one flat and the other offset. See Fig. 4-58.

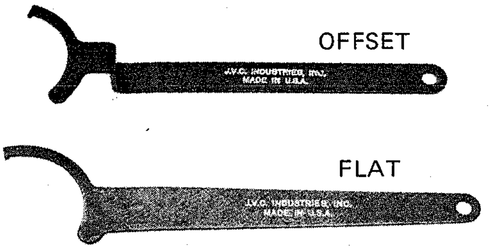


Fig. 4-58

1. Remove lens. Detach front panel from camera by removing the two screws from the left and right sides. Referring to Fig. 4-60, confirm that there is no gap between the main lens barrel and the section at the rear held by three set screws. If any gap exists, loosen the set screws and push rear section forward. Then tighten set screws.
2. Refer to Fig. 4-61. Loosen the set screw ① on the mount-base. Use acetone to remove glue from locking ring ② and lens ring ③. Using only hand pressure, loosen the locking ring ② by engaging the offset wrench, with its trademark side facing forward, in a slot of the lens ring ③ and holding it fixed. At the same time, turn the locking ring ② with the flat wrench, trademark to rear, rotated CCW. Do NOT strike wrenches. If necessary use additional acetone to dissolve remaining glue.

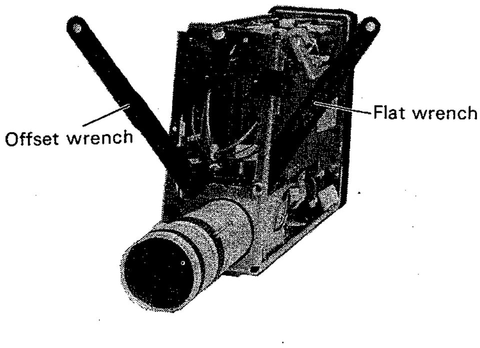


Fig. 4-59

3. Replace lens, set at f2, with appropriate ND filter(s) if necessary. Select a subject more than 50ft (15m) away and set focus to infinity.
4. Zoom to full close-up. Rotate the entire lens until best focus is obtained. Zoom to long-shot and rotate the entire lens again to see if focus can be improved. Repeat until no further improvement is possible.
5. Use the resolution chart at a distance of 10ft (3m) from the camera. Zoom to close-up and rorate the focus ring until best focus is obtained. Zoom to long-shot and rotate the focus ring again. If focus is hereby improved, repeat steps 3–4 until no further improvement is possible. Index lines (Fig. 4-60) should now be rotated 10–15° CW of correct position.

   Hold the lens to prevent it from rotating and carefully tighten the locking ring by using the two wrenches as in step 2, but with wrenches flipped over to their opposite sides. Rotate offset wrench CCW, while rotating flat wrench CW. Offset wrench can be placed through front opening in frame.
6. Tighten set screw ①, Fig. 4-61, to secure back-focus adjustment. Make final adjustment of index lines by marking rear section with pencil at proper position, removing lens and matching index lines to mark.

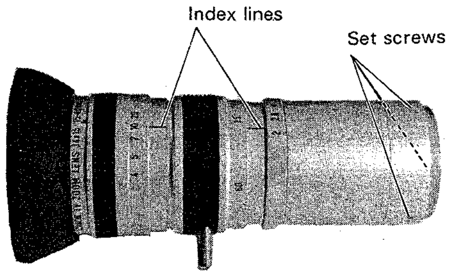


Fig. 4-60

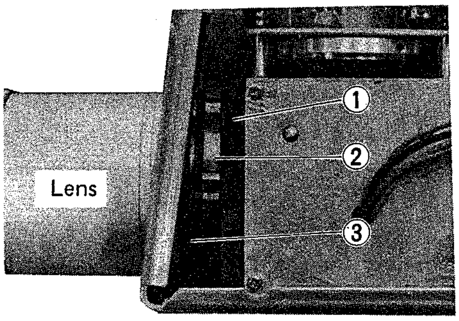
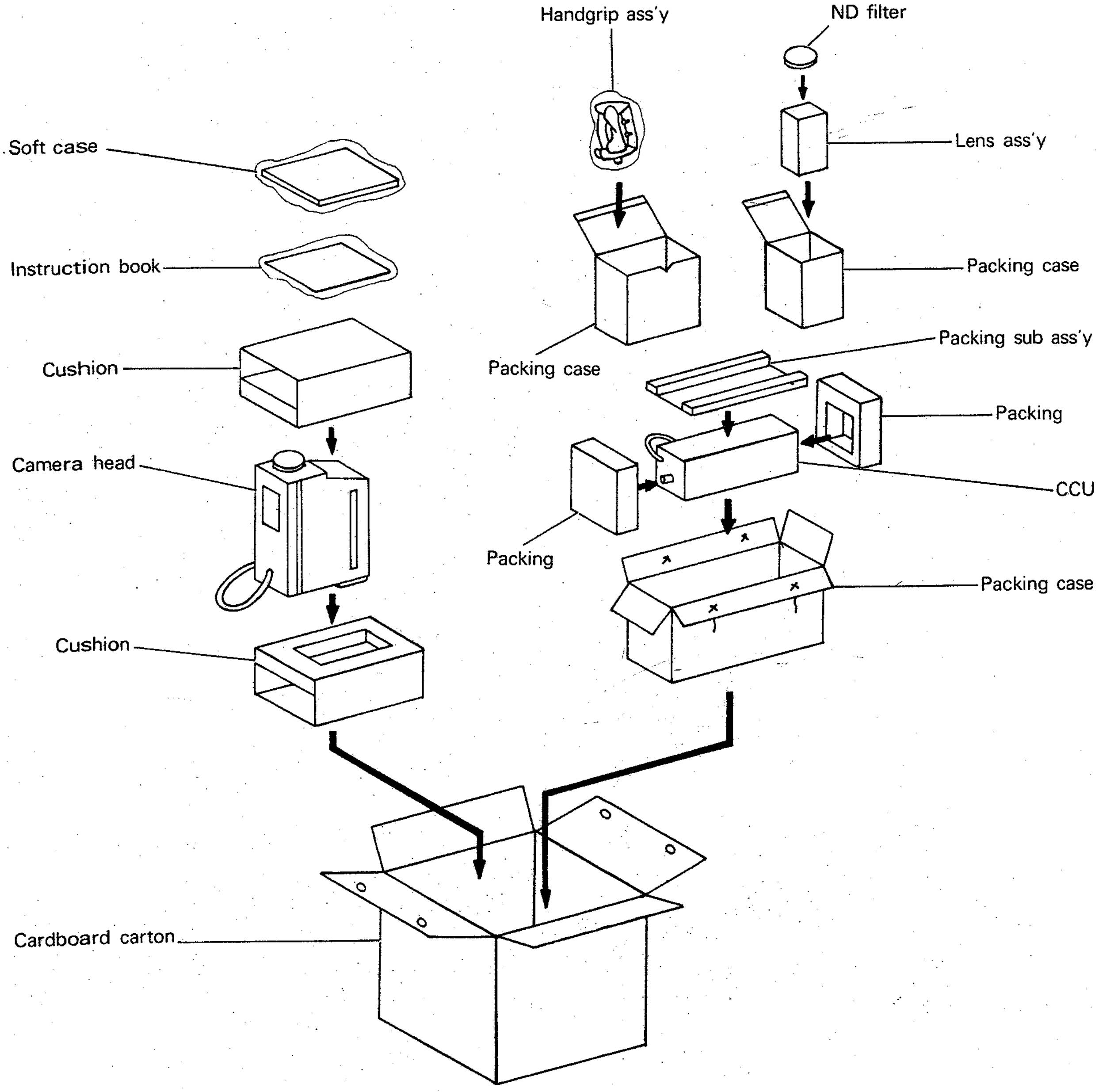


Fig. 4-61

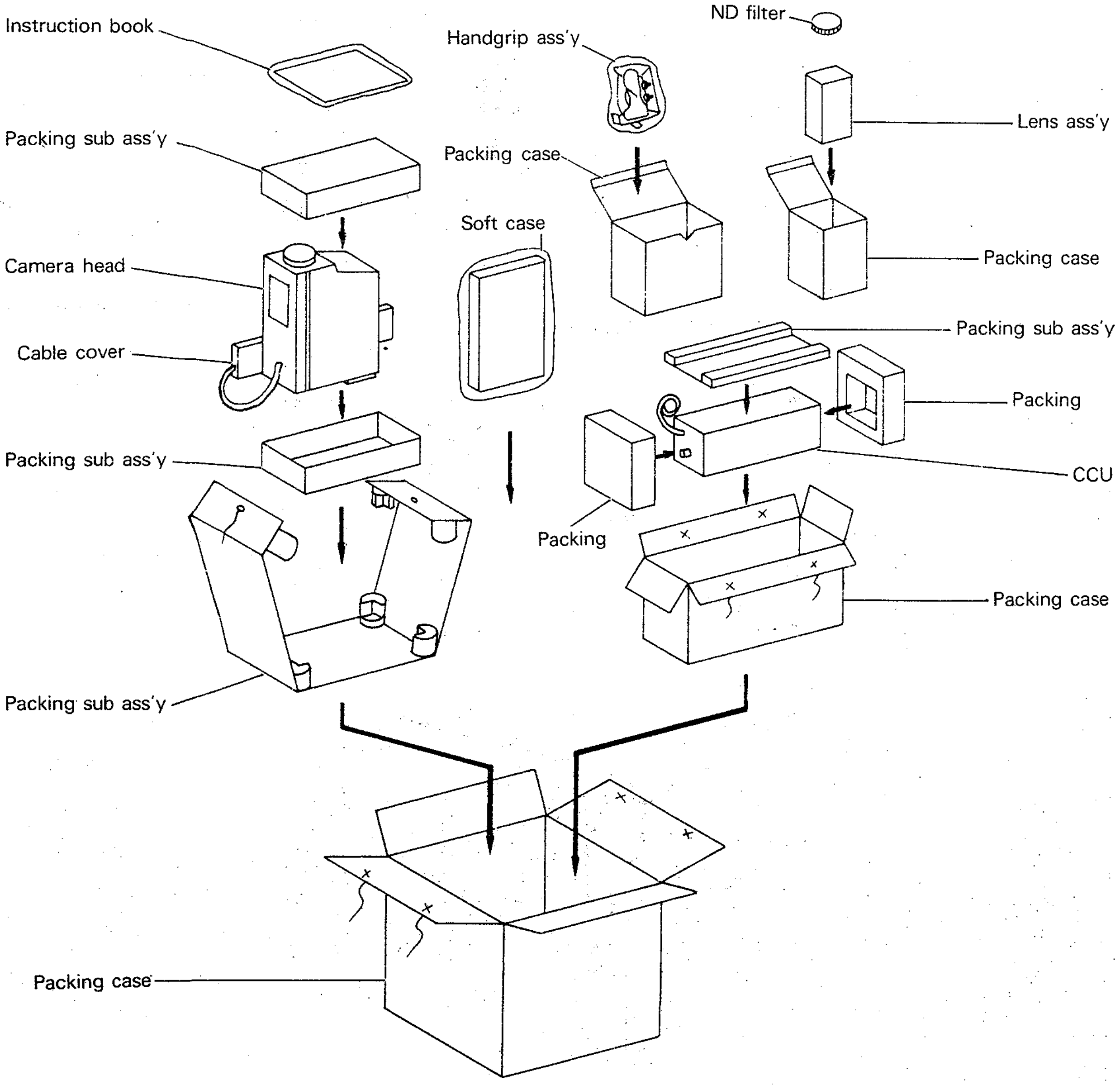
SECTION 5
REPACKING

5-1 MODIFIED REPACKING (See 5-2 for ORIGINAL REPACKING)


Handgrip ass'y
ND filter
Soft case
Lens ass'y
Instruction book
Packing case
Cushion
Packing case
Packing sub ass'y
Packing
Camera head
CCU
Packing
Packing case
Cushion
Cardboard carton

Affected Serial Number : □□□□0135 and later

5-2 ORIGINAL REPACKING


Instruction book
Handgrip ass'y
ND filter
Lens ass'y
Packing sub ass'y
Packing case
Soft case
Packing case
Camera head
Packing sub ass'y
Cable cover
Packing
CCU
Packing sub ass'y
Packing
Packing case
Packing sub ass'y
Packing case

Affected Serial Number : □□□□0134 and earlier

SECTION 6
EXPLODED VIEWS AND PARTS LIST

6-1 CHASSIS ASSEMBLY (1)
6-2 CHASSIS ASSEMBLY (2)
6-3 CHASSIS ASSEMBLY (3)
6-4 OPTICAL BLOCK ASSEMBLY
6-5 LENS ASSEMBLY
6-6 HANDGRIP ASSEMBLY
6-7 CAMERA CONTROL UNIT ASSEMBLY

In these exploded views the part numbers of the screws and washers designate the type and dimensions* of those items. The following examples will help you to decipher them.

Examples:

SPSP3006ZS
- ZS — "ISO" metric screw thread
- 06 — Length in mm (6 mm)
- 30 — Diameter in mm (3 mm)
- SPSP — Cross-recrossed, pan head screw

LPSP3014ZS
- 14 — Length: 14 mm
- 30 — Diameter: 3 mm
- LPSP — Cross-recrossed, pan head screw with lock washer

DPSP4008ZS
- 40 — Diameter: 4 mm
- DPSP — Cross-recrossed, pan head screw with lock washer and plain washer

SSSP3008ZS
- SSSP — Cross-recrossed, flat countersunk head screw

SDBP3006NS
- SDBP — Cross-recrossed, binding head screw

YRS3004FS
- YRS — Hexagon socket set screw with sunken tip

YFS3006FS
- YFS — Hexagon socket screw with flat tip

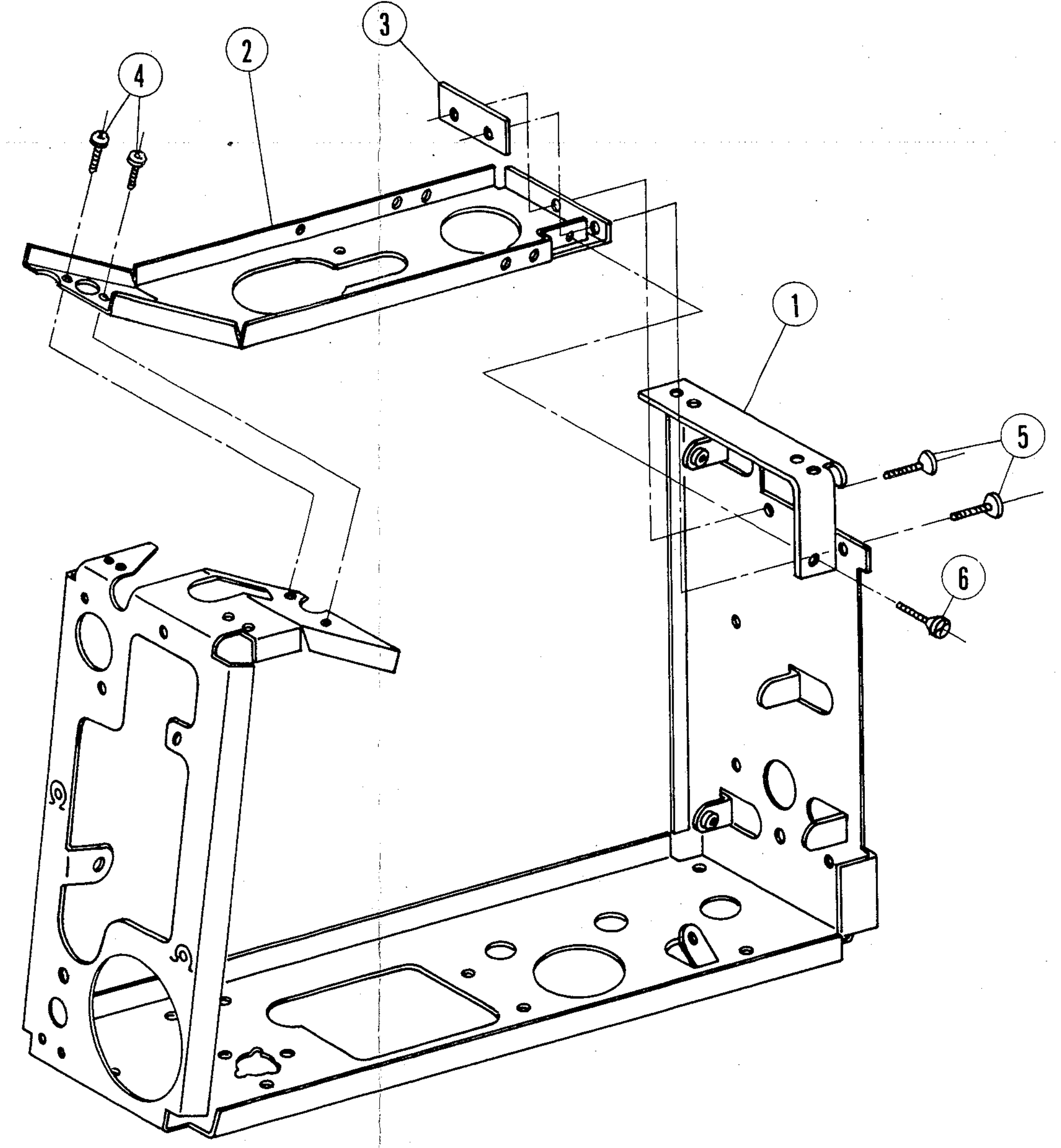
BYS3006FS
- BYS — Hexagon socket head bolt

WLS3000
- 3000 — Diameter of the applicable screw (3 mm screw)
- WLS — Lock washer

WNS3000Z
- WNS — Plain metal washer

REE4000
- 4000 — Diameter of a slot be around the face of a stud which applies (usually the stud's diameter is 5 mm and slot's is 4 mm).
- REE — Retaining ring ("E" type)

6-1 CHASSIS ASSEMBLY (1)



Symbol No.	Part No.	Part Name	Description
1	PU20314A	Chassis ass'y	
2	PU30815	Bracket	
3	PU42822	Plate nut	
4	DPSP3006ZS	Screw	
5	SSSP3006ZS	Screw	
6	SSSP2006N	Screw	

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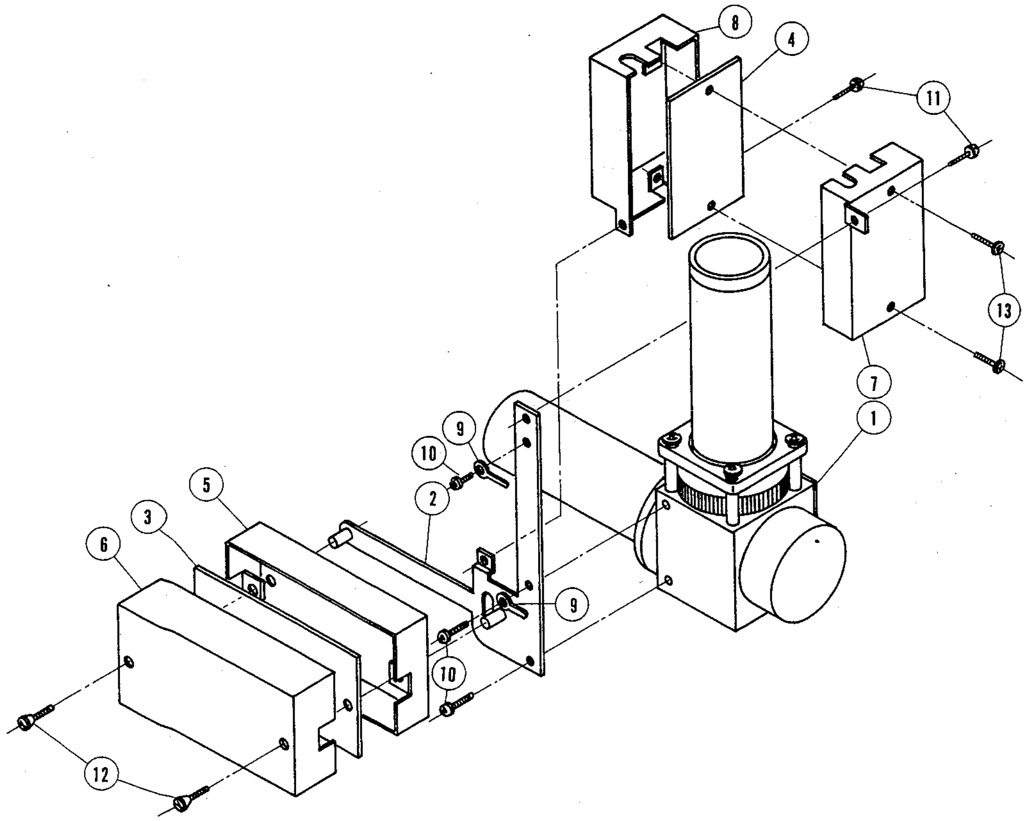
* For those not yet familiar with the international metric system, one inch = approximately 25 millimeters (1 in.=25.4 mm).

Symbol No.	Part No.	Part Name	Description
1		Chassis ass'y	See Chassis ass'y parts list (1)
2		Chassis ass'y	See Chassis ass'y parts list (3)
3	PU20308A	Handgrip ass'y	See Handgrip ass'y parts list
4	PU42888A	Main amp. P.W.B. ass'y	
5	PU42896A	DC-DC conv. P.W.B. ass'y	
6	PU42973A	ASC P.W.B. ass'y	
7	40CB4	1.5 inch CRT	measured diagonally
8	PU42906	CRT yoke ass'y	
9	PU30837	CRT socket ass'y	
10	PU42806A	CRT cover ass'y	
11	PU42858	Sheet	
12	PU42804A	Supporter ass'y	
13	PU42805A	Holder ass'y	
14	PU30037-3	Front microphone	
15	PU42958	Microphone cover	
16	QSP2210-003	Switch	
17	PU42819	Switch bracket	
18	PU42818	Cover	
19	LN22	Light-emitting diode	D801
20	PU41501-2	Bushing	
21	PU42959	Bracket	
22	2SA671C	Transistor	X801
23	QML1320-253	Lug strip ass'y	4P
24	QRD141K-104	C. resistor	R801, R802
25	QFH42JM-473	M.F. capacitor	C801, C802
26	PU42816	Cover	
27	PU42073	Sticker	
28	PU30810B	H.V. unit ass'y	
29	PU30816	Shield case	
30	PU30817A	Shield case cover ass'y	
31	PU30826B	Camera cable ass'y	
32	PU30884	Insulator	
33	55234	Wiring clamp	
34	PU30820A	Front cover ass'y	
35	PU43079-2	Mark	
36	PU42849	Button	
37	PU20313	Rear cover	
38	PU42812	Hook	
39	PSE2020	Spring pin	
40	PU42834A	V.F. cover ass'y	
41	PU42811	Hinge	
42	PU42813	Leaf spring	
43	PU42815A	Eye piece ass'y	
44	PU42842	Caution plate	
45	PU42851	Top cover	
46	PU42832A	Side cover (R) ass'y	
47	PU30818-2	Side mark	
48	PU42833A	Side cover (L) ass'y	
49	PU30459-17	Serial number plate	
50	PU42848	Foot	
51	PU41705	Speed nut	
52	PU42846	Knob	
53	PU42847	Knob	
54			
55	PU42820A	Base ass'y	
56	PU30756	Lens ass'y	See Lens ass'y parts list
57	GU46119-4	Cord stopper	
58	PU42091	Number plate	
59	Q03093-802	Washer	
60	SPSP2018Z	Screw	
61	SPSP2014Z	Screw	
62	SPSP2006Z	Screw	
63	SPSP2006F	Screw	
64	SSSP2004N	Screw	
65	SSSP2004F	Screw	
66	LPSP2604Z	Screw	
67	DPSP2606Z	Screw	
68	SBSB3006Z	Tap screw	
69	DPSP3008ZS	Screw	
70	SSSP3008NS	Screw	
71	LPSP3006ZS	Screw	
72	SDBP3008RS	Screw	
73	SPSP3006FS	Screw	
74	SPSP3006NS	Screw	
75	WNS2000N	Washer	
76	NNB2000N	Nut	
77	NNB3000NS	Nut	

6-3 CHASSIS ASSEMBLY (3)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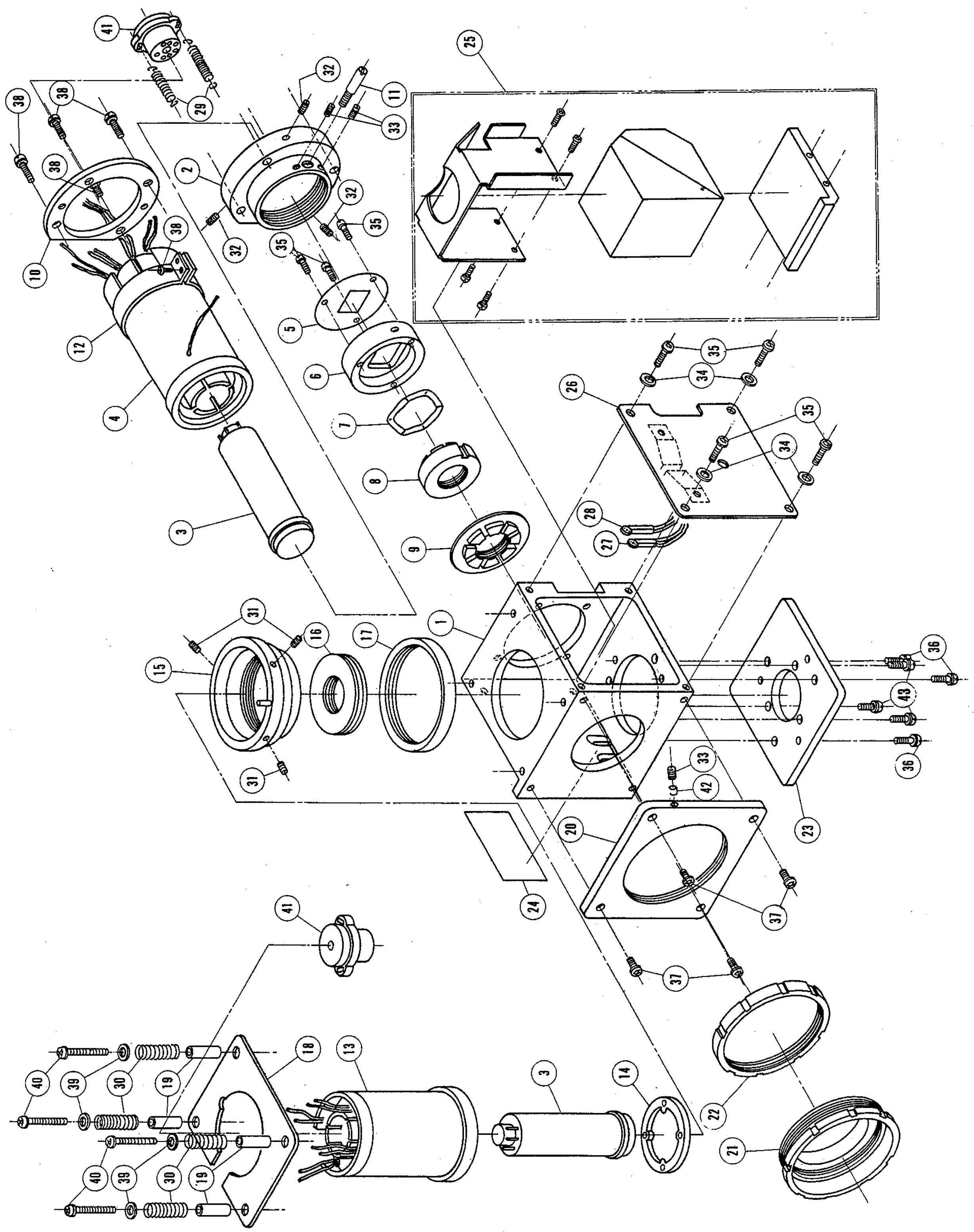
Symbol No.	Part No.	Part Name	Description
1	PU20307A	Optical block ass'y	Including No.2
2	PU42827A	Bracket ass'y	
3	PU42887A	Chroma pre-amp ass'y	
4	PU42886A	Y pre-amp. ass'y	
5	PU42825	Shield case	
6	PU42823	Shield case cover	
7	PU42826A	Shield case ass'y	
8	PU42824A	Shield case cover ass'y	
9	55234	Clamper	
10	LPSP3006ZS	Screw	
11	DPSP3006ZS	Screw	
12	SSSP3025ZS	Screw	
13	LPSP2606Z	Screw	

6-4 OPTICAL BLOCK ASSEMBLY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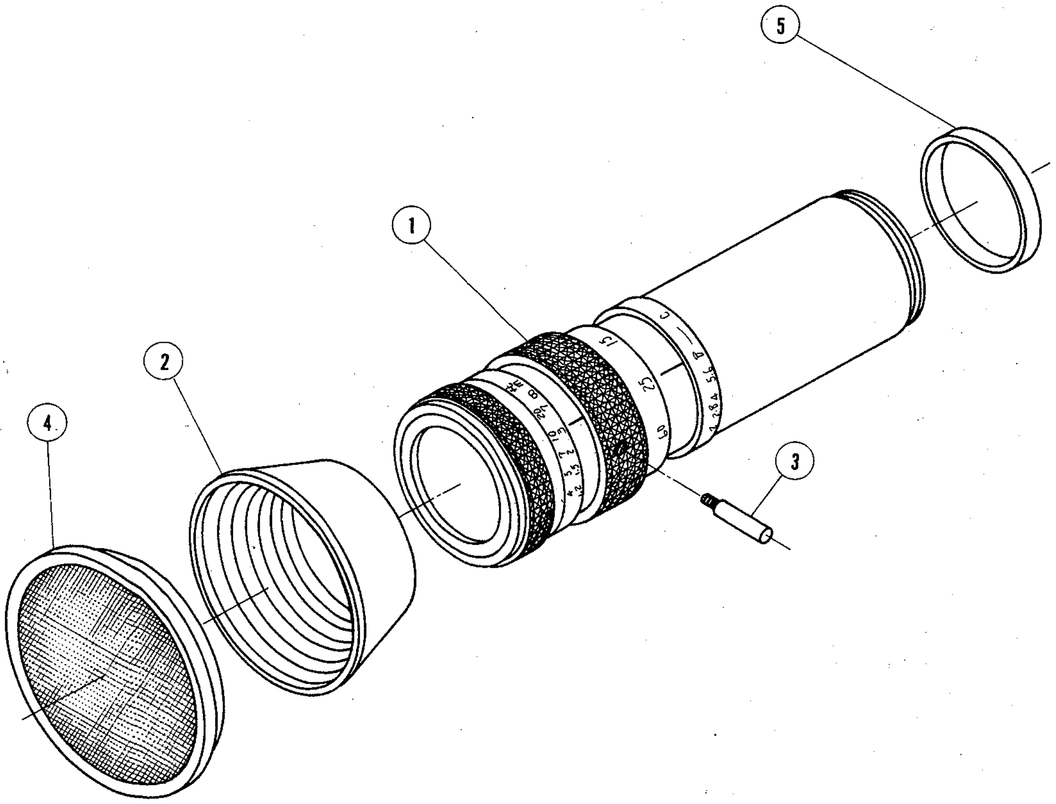
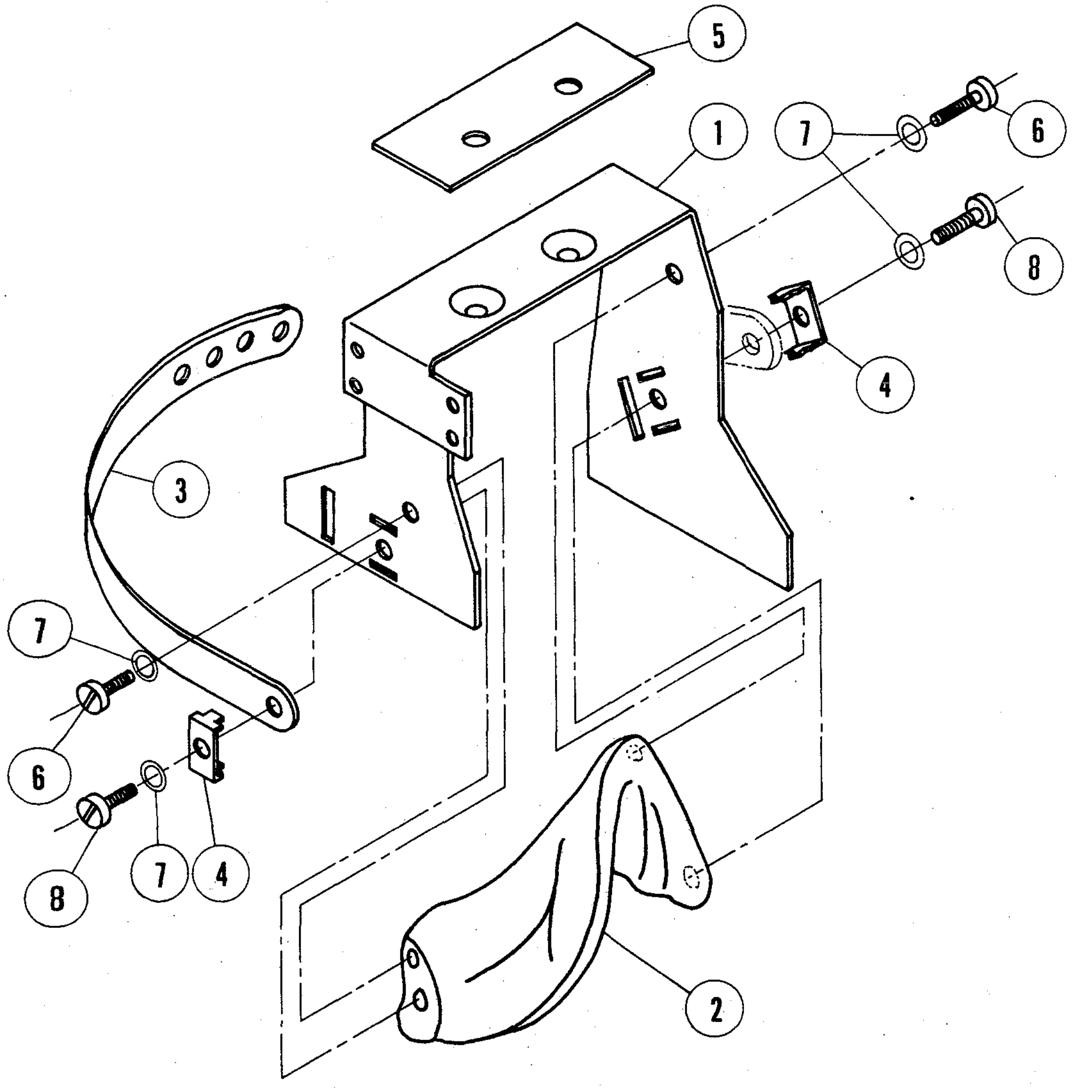
Symbol No.	Part No.	Part Name	Description
1	PU30812	Mount base	
2	PU42773	Vidicon mount (C)	
3	20PE14C	Vidicon	selected type
4	PU42908	Deflection yoke	
5	PU42779	Vidicon screen	
6	PU42780	Screen guide	
7	PU42781	Wave washer	
8	PU42778A	Filter mount ass'y	
9	PU42782	Adjusting ring (C)	
10	PU42771	Vidicon plate (C)	
11	PU42783	Adjustment screw	
12	PU43025	Deflection yoke clamp	
13	PU42908-2	Deflection yoke	
14	PU42772	Retainer	
15	PU42789A	Vidicon clamp ass'y	
16	PU42784	Vidicon base	
17	PU42790	Adjusting ring (Y)	
18	PU42791	Vidicon plate (Y)	
19	PU42792	Spacer	
20	PU42793	Lens mount	
21	PU42794	Lens ring	
22	PU42795	Locking ring	
23	PU42800	Block holder	
24	PU42901	Dust cover	
25	PU42799A	Prism ass'y	
26	PU42803A	Block cover ass'y	
27	ERT-D2FHL103S	Thermister	
28	ERT-D2FHL104S	Thermister	
29	PU35005-19	Spring	
30	PU30080-20	Spring	
31	YFS2604	Set screw	
32	YFS3004S	Set screw	
33	YRS3004S	Set screw	
34	WLS2000N	Washer	
35	SPSP2004ZS	Screw	
36	LPSP3006TS	Screw	
37	LPSP3008TS	Screw	
38	LPSP3015TS	Screw	
39	WNS3000N	Washer	
40	SPSP3025ZS	Screw	
41	PU42902	Vidicon socket	
42	PU43075	Cushion	
43	LPSP3006ZS	Screw	

6-5 LENS ASSEMBLY



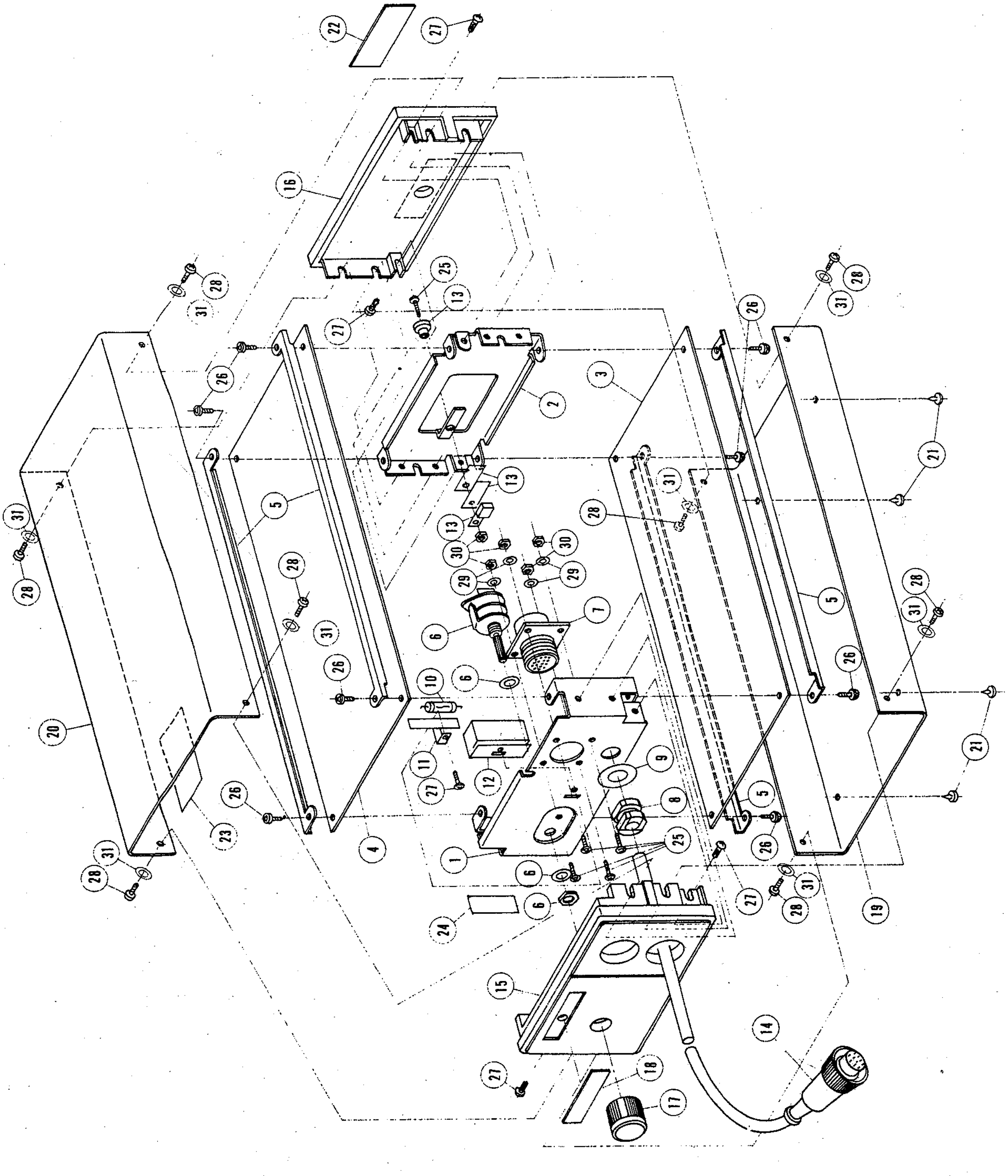
Symbol No.	Part No.	Part Name	Description
1	PU30756-1	Lens	PU30756 Lens ass'y
2	PU30756-2	Hood	
3	PU30756-3	Zoom lever	
4	PU30756-4	Lens cover	
5	PU30756-5	Lens cap	

6-6 HANDGRIP ASSEMBLY



Symbol No.	Part No.	Part Name	Description
1	PU20309	Frame	PU20308A Handgrip ass'y
2	PU20315	Grip	
3	PU42954	Band	
4	PU42955	Supporter	
5	PU42838	Rubber sheet	
6	PU43058	FT screw	
7	Q03093-126	Washer	
8	PU43058-2	FT screw	

6-7 CAMERA CONTROL UNIT ASSEMBLY



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Symbol No.	Part No.	Part Name	Description
1	PU30823A	Front bracket ass'y	
2	PU42854A	Rear bracket ass'y	
3	PU42890A	C.C.U. amp. P.W.B. ass'y (2)	
4	PU42889C	C.C.U. amp. P.W.B. ass'y (1)	
5	PU42852	Angle	
6	QSR3443-202	Rotary switch	
7	PU30834	16 pin connector	
8	GU46119-2	Cord stopper	
9	PU42855	Spacer	
10	QMF66M2-1R6	Fuse	Fuse 1
11	QML1320-253	Lug strip ass'y	
12	PU42882	Cover	
13	2SA699Q	Transistor	X1001
14	PU30836B	Cable ass'y	with 10-pin connector*
15	PU30821	Front cover	
16	PU30822	Rear cover	
17	E46607-001	Knob	
18	PU42853-2	Mark	
19	PU42883A	Cover ass'y	
20	PU42883B	Cover ass'y	
21	PU40348	Plastic button	
22	PU30459-18	Serial No. plate	
23	PU30780-2	Sticker	
24	PU42091	Number plate	
25	SPSP3008ZS	Screw	
26	LPSP3008ZS	Screw	
27	SBSB3008Z	Tap screw	
28	SDBP3008RS	Screw	
29	WLS3000N	Lock washer	
30	NNB3000NS	Nut	
31	Q03093-802	Washer	
32	PU42075	Sticker	

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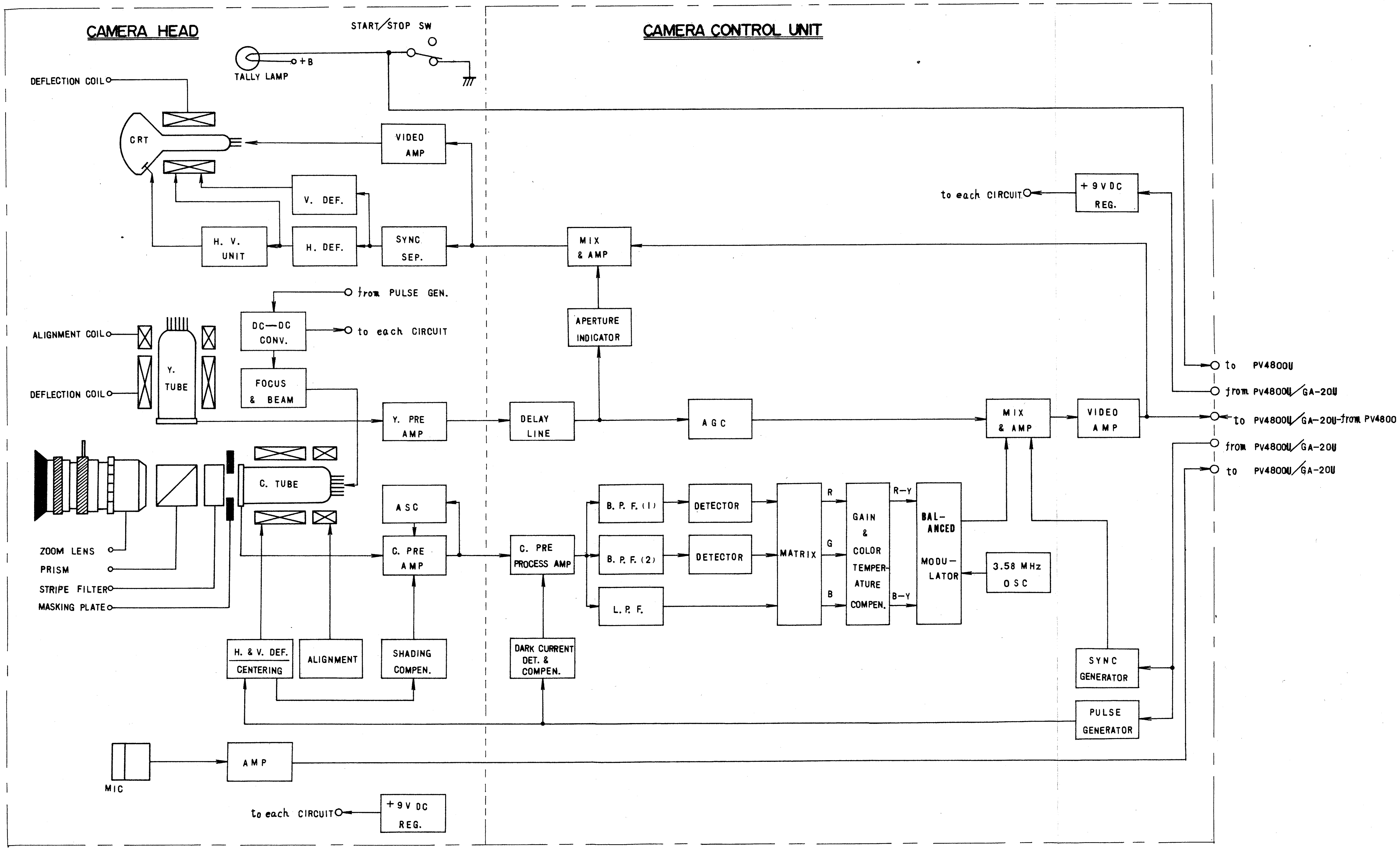
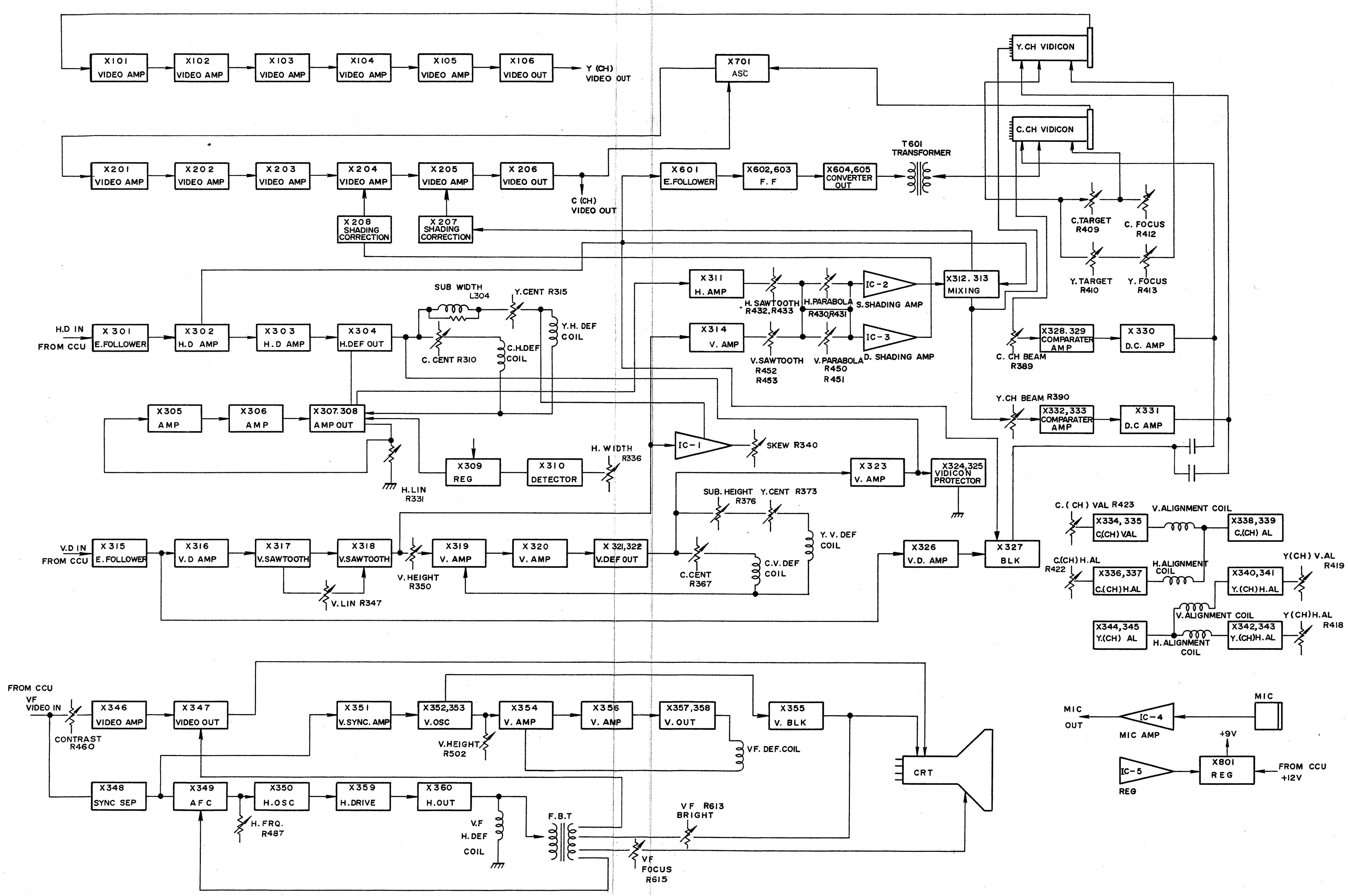
*available separately Part No. GU45800.

SECTION 7
DIAGRAMS AND CIRCUIT BOARDS

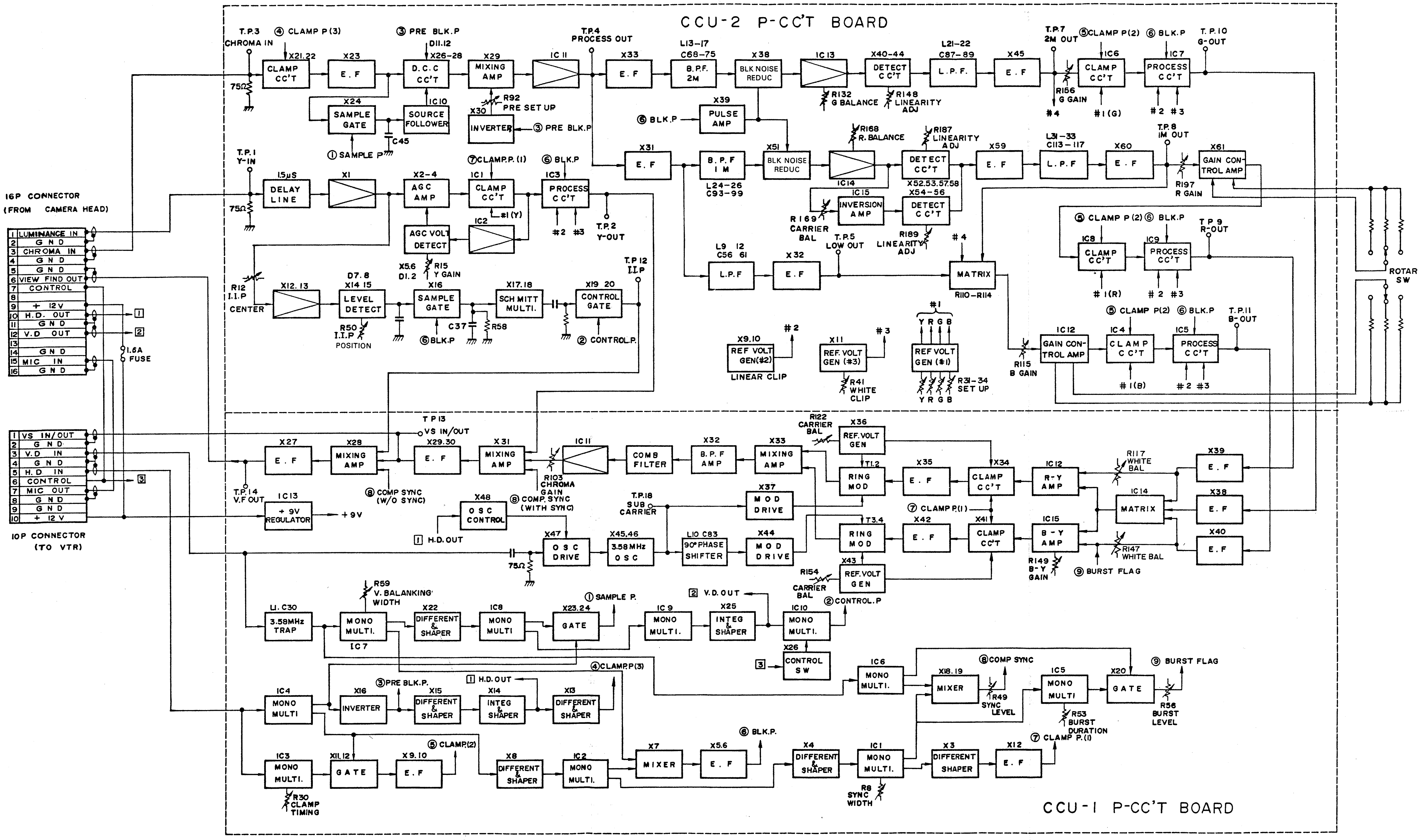
7-1 OVERALL BLOCK DIAGRAM


CAMERA HEAD
START/STOP SW
+B
TALLY LAMP
DEFLECTION COIL
CRT
VIDEO AMP
V. DEF.
H. V. UNIT
H. DEF.
SYNC SEP.
from PULSE GEN.
DC—DC CONV.
to each CIRCUIT
ALIGNMENT COIL
Y. TUBE
DEFLECTION COIL
FOCUS & BEAM
Y. PRE AMP
C. TUBE
ASC
C. PRE AMP
ZOOM LENS
PRISM
STRIPE FILTER
MASKING PLATE
H. & V. DEF. CENTERING
ALIGNMENT
SHADING COMPEN.
MIC
AMP
to each CIRCUIT
+9V DC REG.
CAMERA CONTROL UNIT
MIX & AMP
APERTURE INDICATOR
DELAY LINE
AGC
C. PRE PROCESS AMP
DARK CURRENT DET. & COMPEN.
B. P. F. (1)
B. P. F. (2)
L. P. F.
DETECTOR
DETECTOR
MATRIX
R
G
B
GAIN & COLOR TEMPER-ATURE COMPEN.
R—Y
B—Y
BAL-ANCED MODU-LATOR
3.58 MHz OSC
MIX & AMP
VIDEO AMP
to each CIRCUIT
+9VDC REG.
SYNC GENERATOR
PULSE GENERATOR
to PV4800U
from PV4800U/GA-20U
to PV4800U/GA-20U-from PV4800
from PV4800U/GA-20U
to PV4800U/GA-20U

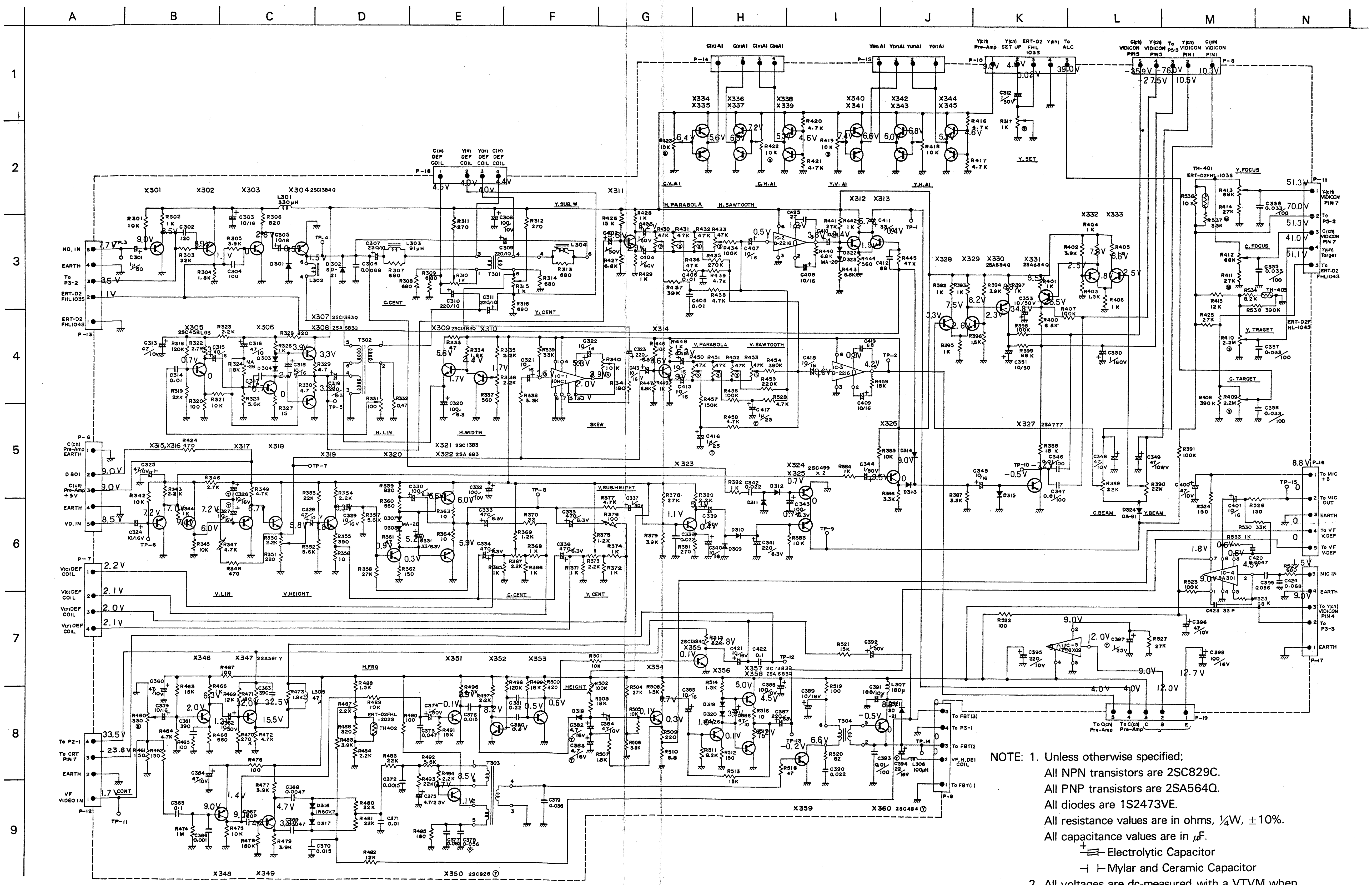
7-2 CAMERA HEAD BLOCK DIAGRAM


X101 VIDEO AMP
X102 VIDEO AMP
X103 VIDEO AMP
X104 VIDEO AMP
X105 VIDEO AMP
X106 VIDEO OUT
Y (CH) VIDEO OUT
X701 ASC
Y.CH VIDICON
C.CH VIDICON
X201 VIDEO AMP
X202 VIDEO AMP
X203 VIDEO AMP
X204 VIDEO AMP
X205 VIDEO AMP
X206 VIDEO OUT
C (CH) VIDEO OUT
X208 SHADING CORRECTION
X207 SHADING CORRECTION
X601 E.FOLLOWER
X602,603 F. F
X604,605 CONVERTER OUT
T601 TRANSFORMER
C.TARGET R409
C. FOCUS R412
Y. TARGET R410
Y. FOCUS R413
SUB WIDTH L304
Y.CENT R315
Y.H. DEF COIL
C.H.DEF COIL
C. CENT R310
H.D IN FROM CCU
X301 E.FOLLOWER
X302 H.D AMP
X303 H.D AMP
X304 H.DEF OUT
X311 H. AMP
H. SAWTOOTH R432, R433
H.PARABOLA R430, R431
IC-2
S.SHADING AMP
X312. 313 MIXING
X314 V. AMP
V.SAWTOOTH R452 R453
V. PARABOLA R450 R451
IC-3
D. SHADING AMP
C. CH BEAM R389
X328.329 COMPARATER AMP
X330 D.C. AMP
Y.CH BEAM R390
X332,333 COMPARATER AMP
X331 D.C AMP
X305 AMP
X306 AMP
X307.308 AMP OUT
H.LIN R331
X309 REG
X310 DETECTOR
H. WIDTH R336
IC-1
SKEW R340
X323 V. AMP
X324,325 VIDICON PROTECTOR
SUB. HEIGHT R376
Y.CENT R373
Y. V. DEF COIL
C.V. DEF COIL
C.CENT R367
V.D IN FROM CCU
X315 E.FOLLOWER
X316 V.D AMP
X317 V.SAWTOOTH
X318 V.SAWTOOTH
V.LIN R347
V. HEIGHT R350
X319 V. AMP
X320 V. AMP
X321,322 V.DEF OUT
X326 V.D. AMP
X327 BLK
C. (CH) VAL R423
V.ALIGNMENT COIL
X334, 335 C(CH) VAL
X338,339 C.(CH) AL
C.(CH) H.AL R422
X336,337 C.(CH) H.AL
H.ALIGNMENT COIL
X340,341 Y.(CH) H.AL
Y(CH) V.AL R419
V.ALIGNMENT COIL
Y(CH) H.AL R418
X344,345 Y.(CH) AL
H.ALIGNMENT COIL
X342,343 Y.(CH) H. AL
FROM CCU VF VIDEO IN
CONTRAST R460
X346 VIDEO AMP
X347 VIDEO OUT
X351 V.SYNC. AMP
X352,353 V.OSC
V.HEIGHT R502
X354 V. AMP
X356 V. AMP
X357,358 V. OUT
VF. DEF.COIL
X355 V. BLK
CRT
X348 SYNC SEP
X349 AFC
H. FRQ. R487
X350 H.OSC
X359 H.DRIVE
X360 H.OUT
V.F H. DEF COIL
F.B.T
VF R613 BRIGHT
VF FOCUS R615
MIC OUT
IC-4
MIC AMP
MIC
+9V
IC-5
REG
X801 REG
FROM CCU +12V

7-3 CCU BLOCK DIAGRAM


CCU-2 P-CC'T BOARD
T.P.3
CHROMA IN
④ CLAMP P(3)
X21.22
CLAMP CC'T
X23
E.F
③ PRE BLK.P
D11.12
X26-28
D.C.C CC'T
X29
MIXING AMP
IC 11
T.P.4
PROCESS OUT
X33
E.F
L13-17
C68-75
B.P.F. 2M
X38
BLK NOISE REDUC
IC 13
X40-44
DETECT CC'T
L21-22
C87-89
L.P.F.
X45
E.F
T.P.7
2M OUT
⑤CLAMP P(2)
IC6
CLAMP CC'T
⑥ BLK.P
IC7
PROCESS CC'T
T.P.10
G-OUT
75Ω
X24
SAMPLE GATE
IC10
SOURCE FOLLOWER
C45
① SAMPLE P
R92
PRE SET UP
X30
INVERTER
③ PRE BLK.P
⑥ BLK.P
X39
PULSE AMP
R132
G BALANCE
R148
LINEARITY ADJ
R156
G GAIN
#4
#1(G)
#2 #3
T.P.8
IM OUT
T.P.1
Y-IN
1.5μS
DELAY LINE
X1
X2-4
AGC AMP
⑦CLAMP.P.(1)
IC1
CLAMP CC'T
#1(Y)
⑥ BLK.P
IC3
PROCESS CC'T
#2 #3
T.P.2
Y-OUT
X31
E.F
B.P.F IM
L24-26
C93-99
X51
BLK NOISE REDUC
IC14
R168
R.BALANCE
R187
LINEARITY ADJ
DETECT CC'T
X52.53.57.58
X54-56
IC15
INVERSION AMP
DETECT CC'T
X59
E.F
L31-33
C113-117
L.P.F
X60
E.F
X61
GAIN CONTROL AMP
R197
R GAIN
16P CONNECTOR
(FROM CAMERA HEAD)
1 LUMINANCE IN
2 GND
3 CHROMA IN
4 GND
5 GND
6 VIEW FIND OUT
7 CONTROL
8
9 +12V
10 H.D. OUT
11 GND
12 V.D OUT
13
14 GND
15 MIC IN
16 GND
1
2
1.6A FUSE
IC2
AGC VOLT DETECT
X5.6
D1.2
R15
Y GAIN
R169
CARRIER BAL
T.P.5
LOW OUT
R189
LINEARITY ADJ
#4
⑤ CLAMP P(2)
⑥ BLK.P
T.P.9
R-OUT
IC8
CLAMP CC'T
IC9
PROCESS CC'T
L9 12
C56 61
L.P.F
X32
E.F
MATRIX
R110-R114
#1(R)
#2 #3
ROTARY SW
R12
I.I.P
CENTER
X12.13
D7.8
X14 15
LEVEL DETECT
R50
I.I.P
POSITION
X16
SAMPLE GATE
C37
R58
⑥BLK.P
X17.18
SCH MITT MULTI.
X19 20
CONTROL GATE
② CONTROL.P
T.P 12
I.I.P
#1
YRGB
#2
#3
X9.10
REF VOLT GEN(#2)
LINEAR CLIP
X11
REF. VOLT GEN (#3)
R41
WHITE CLIP
REF VOLT GEN (#1)
R31-34
SET UP
YRGB
⑤ CLAMP P(2)
⑥ BLK.P
T.P.11
B-OUT
IC12
GAIN CONTROL AMP
R115
B GAIN
IC4
CLAMP CC'T
IC5
PROCESS CC'T
#1(B)
#2 #3
1 VS IN/OUT
2 GND
3 V.D IN
4 GND
5 H.D IN
6 CONTROL
7 MIC OUT
8 GND
9 GND
10 +12V
3
10P CONNECTOR
(TO VTR)
T.P13
VS IN/OUT
X27
E.F
X28
MIXING AMP
X29.30
E.F
X31
MIXING AMP
IC11
R103
CHROMA GAIN
COMB FILTER
X32
B.P.F AMP
X33
MIXING AMP
R122
CARRIER BAL
X36
REF.VOLT GEN
T1.2
RING MOD
X35
E.F
X34
CLAMP CC'T
IC12
R-Y AMP
R117
WHITE BAL
IC14
MATRIX
X39
E.F
X38
E.F
X40
E.F
T.P.14
V.F OUT
IC13
+9V REGULATOR
+9V
⑧ COMP SYNC
(W/O SYNC)
X48
OSC CONTROL
⑧ COMP. SYNC
(WITH SYNC)
T.P.18
SUB CARRIER
X37
MOD DRIVE
⑦ CLAMP P(1)
T3.4
RING MOD
X42
E.F
X41
CLAMP CC'T
IC15
B-Y AMP
R147
WHITE BAL
R149
B-Y GAIN
⑨ BURST FLAG
1 H.D. OUT
X47
OSC DRIVE
75Ω
X45.46
3.58MHz OSC
L10 C83
90°PHASE SHIFTER
X44
MOD DRIVE
R154
CARRIER BAL
X43
REF.VOLT GEN
② CONTROL.P
R59
V. BALANKING WIDTH
L1.C30
3.58MHz TRAP
MONO MULTI.
IC7
X22
DIFFERENT & SHAPER
IC8
MONO MULTI
① SAMPLE P.
X23.24
GATE
IC9
MONO MULTI.
2 V.D. OUT
X25
INTEG & SHAPER
IC10
MONO MULTI.
X26
3
CONTROL SW
④CLAMP.P(3)
IC6
MONO MULTI.
⑧COMP SYNC
X18.19
MIXER
R49
SYNC LEVEL
IC5
MONO MULTI
R53
BURST DURATION
X20
GATE
⑨ BURST FLAG
R56
BURST LEVEL
IC4
MONO MULTI
X16
INVERTER
③PRE BLK.P.
X15
DIFFERENT & SHAPER
1 H.D. OUT
X14
INTEG & SHAPER
X13
DIFFERENT & SHAPER
⑥ BLK.P.
⑦ CLAMP P.(1)
IC3
MONO MULTI.
R30
CLAMP TIMING
X11.12
GATE
X9.10
E.F
⑤ CLAMP(2)
X8
DIFFERENT & SHAPER
IC2
MONO MULTI.
X7
MIXER
X5.6
E.F
X4
DIFFERENT & SHAPER
IC1
MONO MULTI.
R8
SYNC WIDTH
X3
DIFFERENT SHAPER
X12
E.F
CCU-1 P-CC'T BOARD

7-4 MAIN AMPLIFIER SCHEMATIC DIAGRAM.


A
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C
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L
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1
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3
4
5
6
7
8
9
HD. IN
EARTH
To P3-2
ERT-D2 FHL103S
ERT-D2 FHL104S
P-13
C(ch) Pre-Amp EARTH
D801
C(ch) Pre-Amp +9V
EARTH
VD. IN
P-6
P-7
V(c) DEF COIL
V(c) DEF COIL
V(Y) DEF COIL
V(Y) DEF COIL
To P2-1
To CRT PIN 7
EARTH
VF VIDEO IN
P-12
TP-11
P-18
C(H) DEF COIL
Y(H) DEF COIL
Y(H) DEF COIL
C(H) DEF COIL
P-14
C(V)A1
C(H)A1
C(V)A1
C(H)A1
P-15
Y(H)A1
Y(V)A1
Y(H)A1
Y(V)A1
P-10
Y(ch) Pre-Amp
Y(ch) SET UP
ERT-D2 FHL 103S
Y(ch) ALC
C(ch) VIDICON PIN5
Y(ch) VIDICON PIN5
To P5-3
Y(ch) VIDICON PIN1
C(ch) VIDICON PIN1
P-8
P-11
Y(ch) VIDICON PIN 7
To P5-2
C(ch) VIDICON PIN 7
Y(ch) Target
To ERT-D2 FHL104S
P-16
To MIC +B
To MIC OUT
EARTH
To VF V.DEF
To VF V.DEF
MIC IN
EARTH
To Y(ch) VIDICON PIN 4
To P3-3
EARTH
P-17
P-19
To C(ch) Pre-Amp
To C(ch) Pre-Amp
To FBT(3)
To P3-1
To FBT(2)
VF, H. DEF COIL
To FBT(1)
P-9
Y.SUB.W
C.CENT
Y.CENT
H.LIN
H.WIDTH
SKEW
H.PARABOLA
H.SAWTOOTH
V.PARABOLA
V.SAWTOOTH
C.V.A1
C.H.A1
Y.V.A1
Y.H.A1
Y.SET
Y.FOCUS
C.FOCUS
Y.TRAGET
C.TARGET
C.BEAM
Y.BEAM
V.LIN
V.HEIGHT
V.SUB.HEIGHT
C.CENT
Y.CENT
H.FRQ
HEIGHT
CONT
TH-401 ERT-D2FHL-103S
X301
X302
X303
X304 2SC1384Q
X305 2SC458LGB
X306
X307 2SC1383Q
X308 2SA683Q
X309 2SC1383Q
X310
X311
X312
X313
X314
X315, X316
X317
X318
X319
X320
X321 2SC1383
X322 2SA683
X323
X324 2SC499
X325
X326
X327 2SA777
X328
X329
X330 2SA684Q
X331 2SA684Q
X332
X333
X334 X335
X336 X337
X338 X339
X340 X341
X342 X343
X344 X345
X346
X347 2SA561Y
X348
X349
X350 2SC828
X351
X352
X353
X354
X355 2SC1384Q
X356
X357 2SC1383Q
X358 2SA683Q
X359
X360 2SC484
IC-1
IC-2 D-2216
IC-3 D-2216
IC-4 BA301
IC-5 RBX05
T301
T302
T303
T304
L301 330μH
L302
L303 91μH
L304
L305
L306 100μH
L307 180μ
TH402
ERT-D2FHL-2025
TP-1
TP-2
TP-3
TP-4
TP-5
TP-6
TP-7
TP-8
TP-9
TP-10
TP-12
TP-13
TP-14
TP-15

NOTE: 1. Unless otherwise specified;

All NPN transistors are 2SC829C.

All PNP transistors are 2SA564Q.

All diodes are 1S2473VE.

All resistance values are in ohms, ¼W, ±10%.

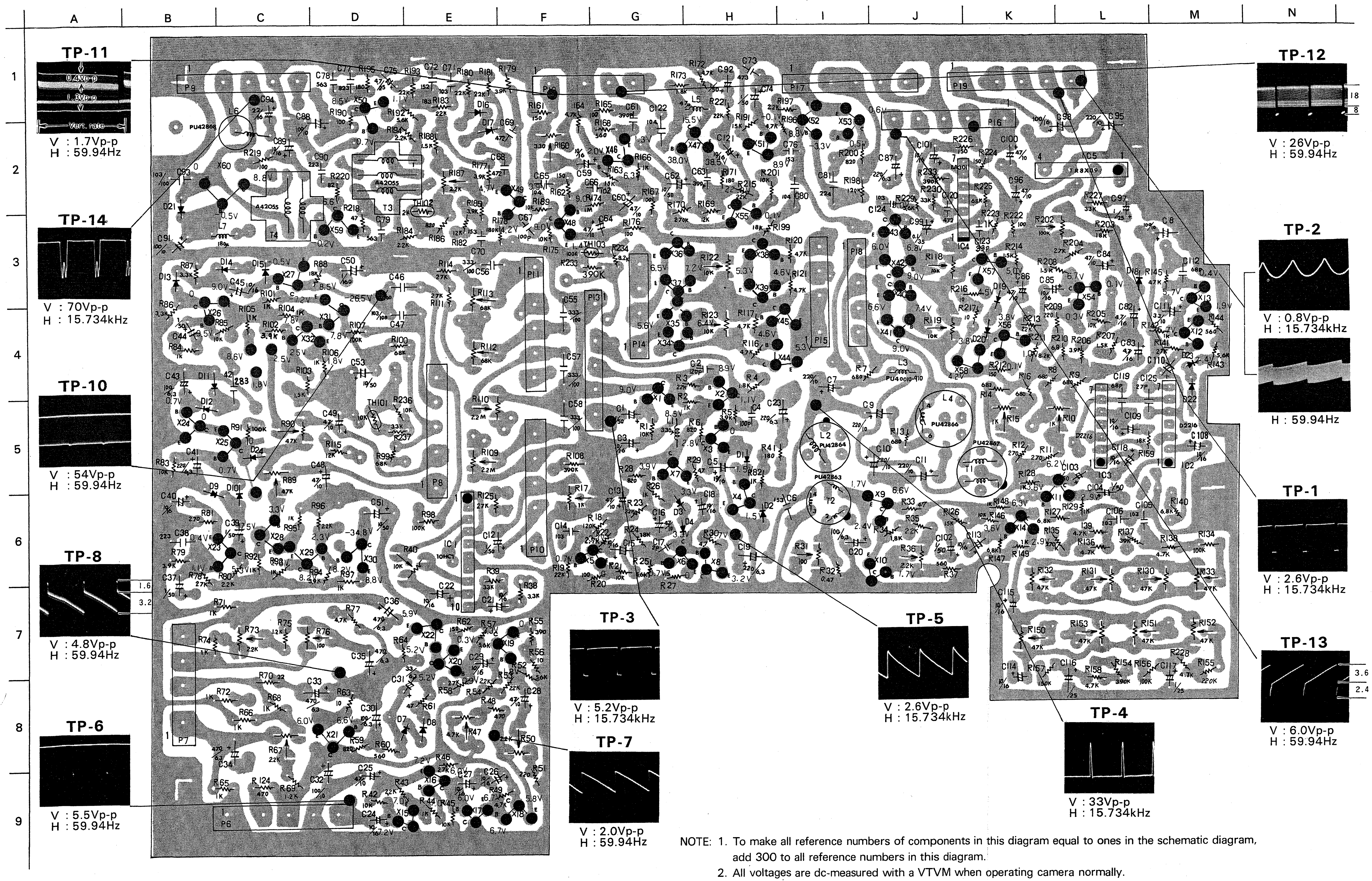
All capacitance values are in μF.

+⊣⊢ Electrolytic Capacitor

⊣⊢ Mylar and Ceramic Capacitor

2. All voltages are dc-measured with a VTVM when operating camera normally.

7-5 MAIN AMPLIFIER CIRCUIT BOARD


A
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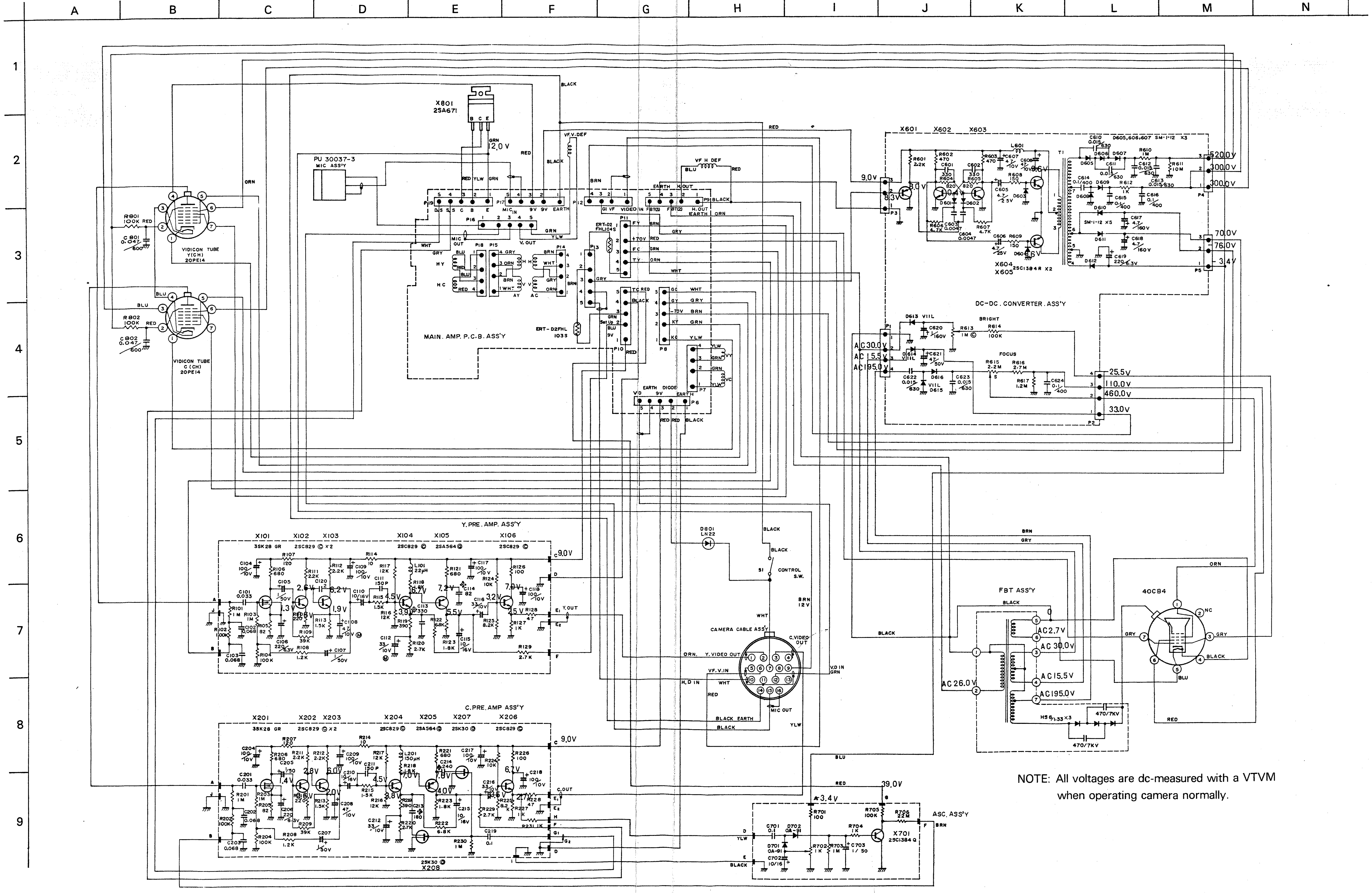
G
H
I
J
K
L
M
N
1
2
3
4
5
6
7
8
9
TP-11
0.4Vp-p
1.3Vp-p
Vert. rate
V : 1.7Vp-p
H : 59.94Hz
TP-14
V : 70Vp-p
H : 15.734kHz
TP-10
V : 54Vp-p
H : 59.94Hz
TP-8
1.6
3.2
V : 4.8Vp-p
H : 59.94Hz
TP-6
V : 5.5Vp-p
H : 59.94Hz
TP-3
V : 5.2Vp-p
H : 15.734kHz
TP-7
V : 2.0Vp-p
H : 59.94Hz
TP-5
V : 2.6Vp-p
H : 15.734kHz
TP-4
V : 33Vp-p
H : 15.734kHz
TP-12
18
8
V : 26Vp-p
H : 59.94Hz
TP-2
V : 0.8Vp-p
H : 15.734kHz
H : 59.94Hz
TP-1
V : 2.6Vp-p
H : 15.734kHz
TP-13
3.6
2.4
V : 6.0Vp-p
H : 59.94Hz

NOTE:
1. To make all reference numbers of components in this diagram equal to ones in the schematic diagram, add 300 to all reference numbers in this diagram.
2. All voltages are dc-measured with a VTVM when operating camera normally.
3. All waveforms apply when using the White Field, Chart No. 2, as the subject.

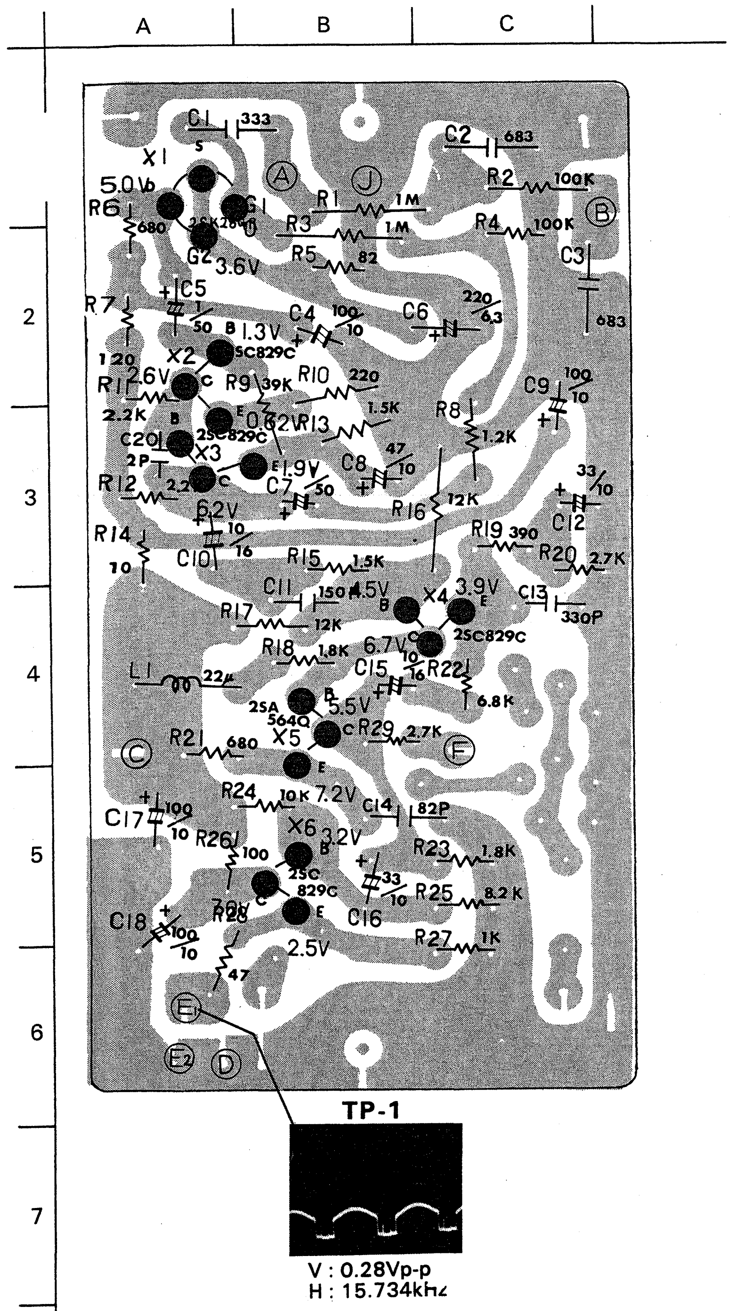
7-6 CAMERA HEAD OVERALL WIRING DIAGRAM

(Including schematics for Y/C Preamplifiers and DC-DC converter/ASC circuits)


A
B
C
D
E
F
G
H
I
J
K
L
M
N
1
2
3
4
5
6
7
8
9
X801
2SA671
PU 30037-3
MIC ASS'Y
VIDICON TUBE
Y(CH)
20PE14
VIDICON TUBE
C(CH)
20PE14
R801
100K
C801
0.047
R802
100K
C802
0.047
MAIN. AMP. P.C.B. ASS'Y
ERT-D2FHL
103S
VF H DEF
X601
X602
X603
DC-DC. CONVERTER. ASS'Y
520.0V
300.0V
300.0V
70.0V
76.0V
3.4V
9.0V
BRIGHT
FOCUS
25.5V
110.0V
460.0V
33.0V
AC30.0V
AC15.5V
AC195.0V
X604
X605
2SC1384R X2
Y.PRE.AMP. ASS'Y
X101
X102
X103
X104
X105
X106
3SK28 GR
2SC829 Ⓒ X2
2SC829 Ⓒ
2SA564Ⓠ
2SC829 Ⓒ
9.0V
Y.OUT
C.PRE.AMP ASS'Y
X201
X202
X203
X204
X205
X207
X206
3SK28 GR
2SC829 Ⓒ X2
2SC829Ⓒ
2SA564Ⓠ
2SK30 Ⓞ
2SC829 Ⓒ
2SK30 Ⓞ
X208
9.0V
C.OUT
D801
LN22
CONTROL S.W.
S1
CAMERA CABLE ASS'Y
Y.VIDEO OUT
C.VIDEO OUT
VF.V.IN
H.D IN
V.D IN
MIC OUT
BLACK EARTH
FBT ASS'Y
AC2.7V
AC 30.0V
AC15.5V
AC195.0V
AC 26.0V
H36 1.33 X3
470/7KV
470/7KV
40CB4
ASC. ASS'Y
X701
2SC1384 Q
39.0V
3.4V

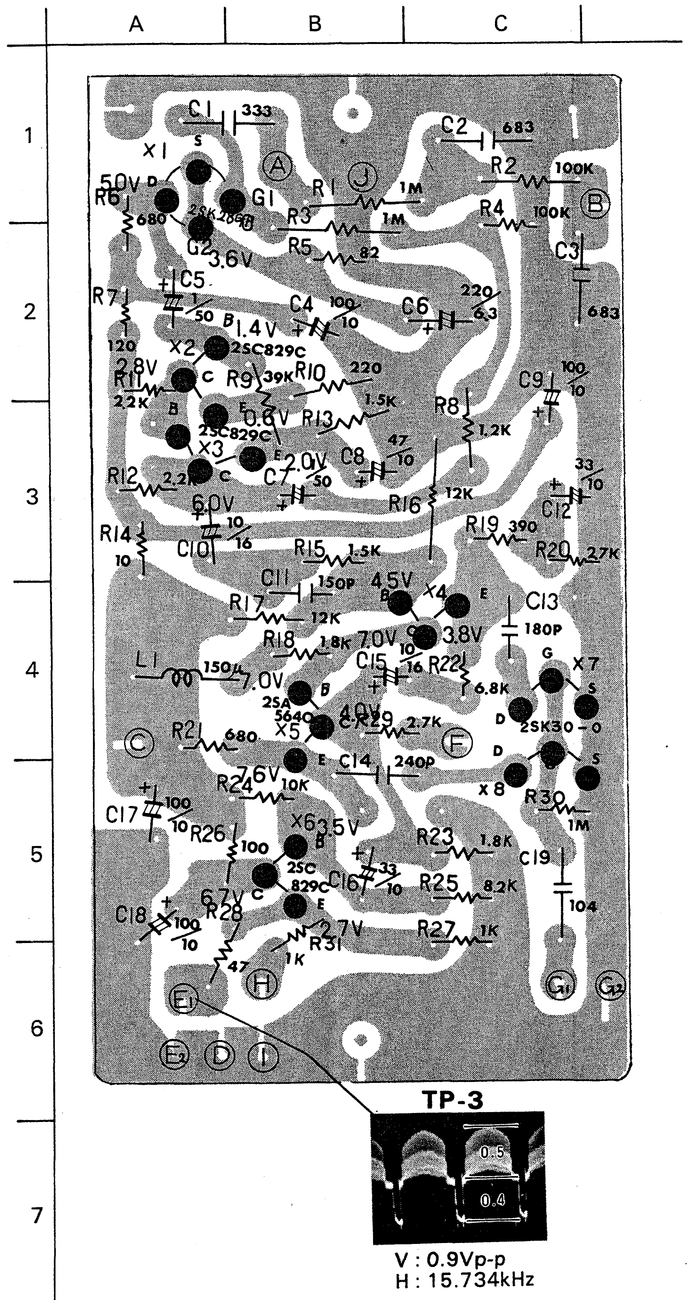
NOTE: All voltages are dc-measured with a VTVM when operating camera normally.

7-7 LUMINANCE (Y) PRE-AMPLIFIER CIRCUIT BOARD


A
B
C
2
3
4
5
6
7
C1 333
C2 683
X1
5.0V
R6 680
G1
R1 1M
R3 1M
R2 100K
R4 100K
R5 82
3.6V
C3 683
C5
R7 120
C4 100 10
C6 220 6.3
1.3V
X2 2SC829C
2.6V
R9 39K
R10 220
R11 2.2K
R13 1.5K
R8 1.2K
C9 100 10
C20 2P
X3 2SC829C
1.9V
C8 47 10
C7 50
R12 2.2K
R16 12K
6.2V
C10 16
R14 10
R15 1.5K
R19 390
C12 33 10
R20 2.7K
C11 150P
4.5V
X4 2SC829C
3.9V
C13 330P
R17 12K
R18 1.8K
6.7V
C15 10 16
R22 6.8K
L1 22μ
X5 2SA564Q
5.5V
R29 2.7K
R21 680
R24 10K
7.2V
C14 82P
C17 100 10
R26 100
X6 2SC829C
3.2V
R23 1.8K
C16 33 10
R25 8.2K
C18 100 10
R28
2.5V
R27 1K
47
TP-1
V : 0.28Vp-p
H : 15.734kHz

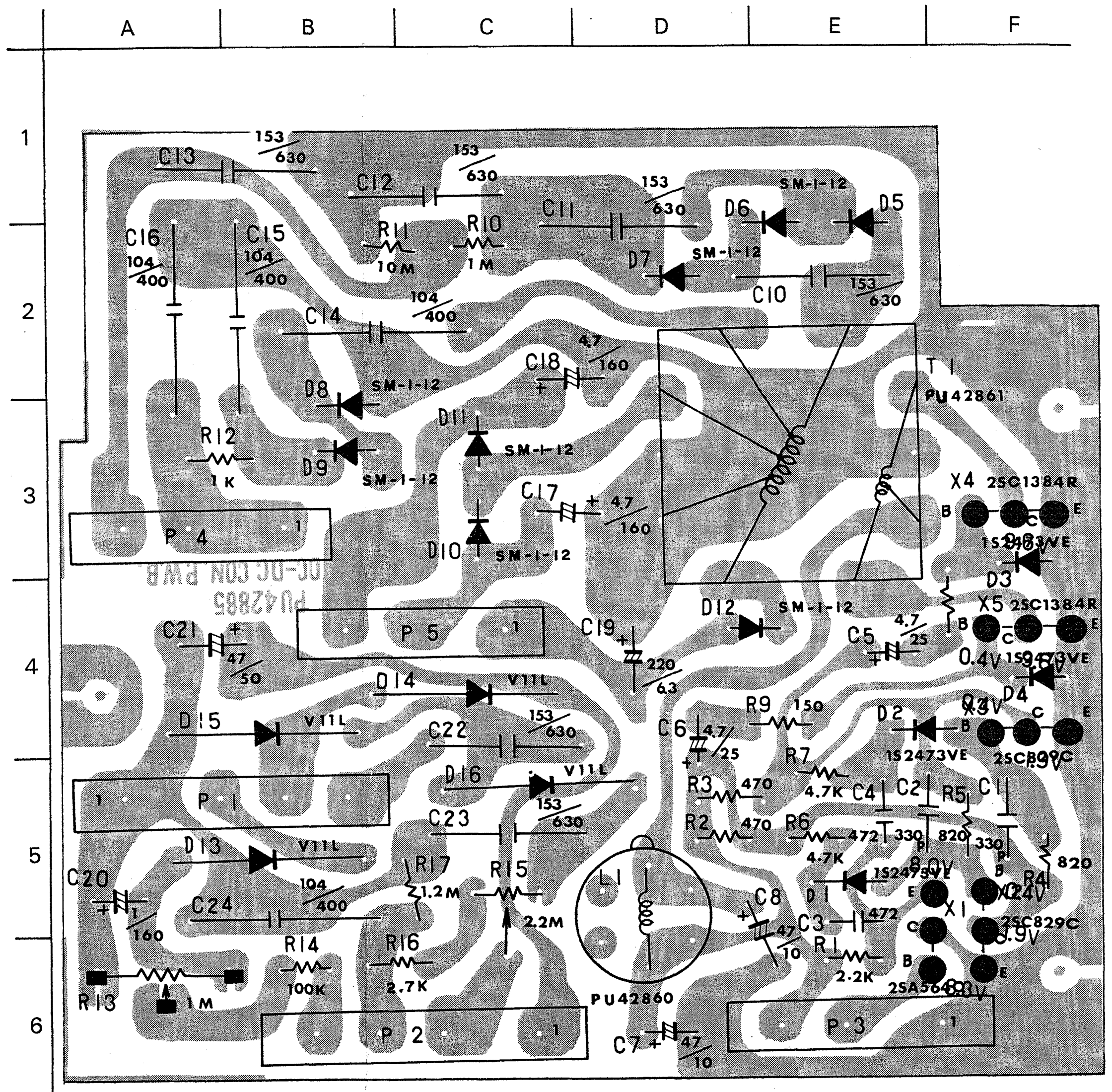
NOTE: 1. All reference numbers of components in this diagram are in 100 series.
2. All voltages are dc-measured with a VTVM when operating camera normally.
3. A waveform applies when using the White Field, Chart No. 2, as the subject.

7-8 CHROMA PRE-AMPLIFIER CIRCUIT BOARD

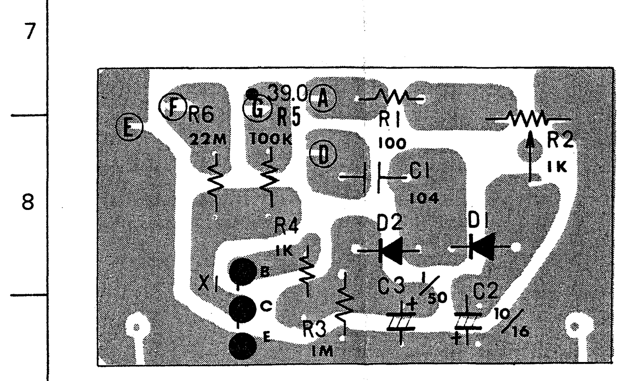

A
B
C
1
2
3
4
5
6
7
C1 333
C2 683
X1
5.0V
R6 680
G1
R1 1M
R3 1M
R2 100K
R4 100K
R5 82
3.6V
C3 683
C5
R7 120
C4 100 10
C6 220 6.3
1.4V
X2 2SC829C
2.8V
R9 39K
R10 220
R11 2.2K
R13 1.5K
R8 1.2K
C9 100 10
X3 2SC829C
0.6V
2.0V
C8 47 10
C7 50
R12 2.2K
R16 12K
6.0V
C10 16
R14 10
R15 1.5K
R19 390
C12 33 10
R20 2.7K
C11 150P
4.5V
X4
C13 180P
R17 12K
R18 1.8K
7.0V
3.8V
C15 16
R22 6.8K
X7 2SK30-O
L1 150μ
7.0V
X5 2SA564Q
4.0V
R29 2.7K
R21 680
R24 10K
7.6V
C14 240P
X8
R30 1M
C17 100 10
R26 100
X6 2SC829C
3.5V
R23 1.8K
C19 104
C16 33 10
R25 8.2K
C18 100 10
R28
6.7V
2.7V
R31 1K
R27 1K
47
TP-3
0.5
0.4
V : 0.9Vp-p
H : 15.734kHz

NOTE: 1. All reference numbers of components in this diagram are in 200 series.
2. All voltages are dc-measured with a VTVM when operating camera normally.
3. A waveform applies when using the White Field, Chart No. 2, as the subject.

7-9 DC-DC CONVERTER AND ASC CIRCUIT BOARD

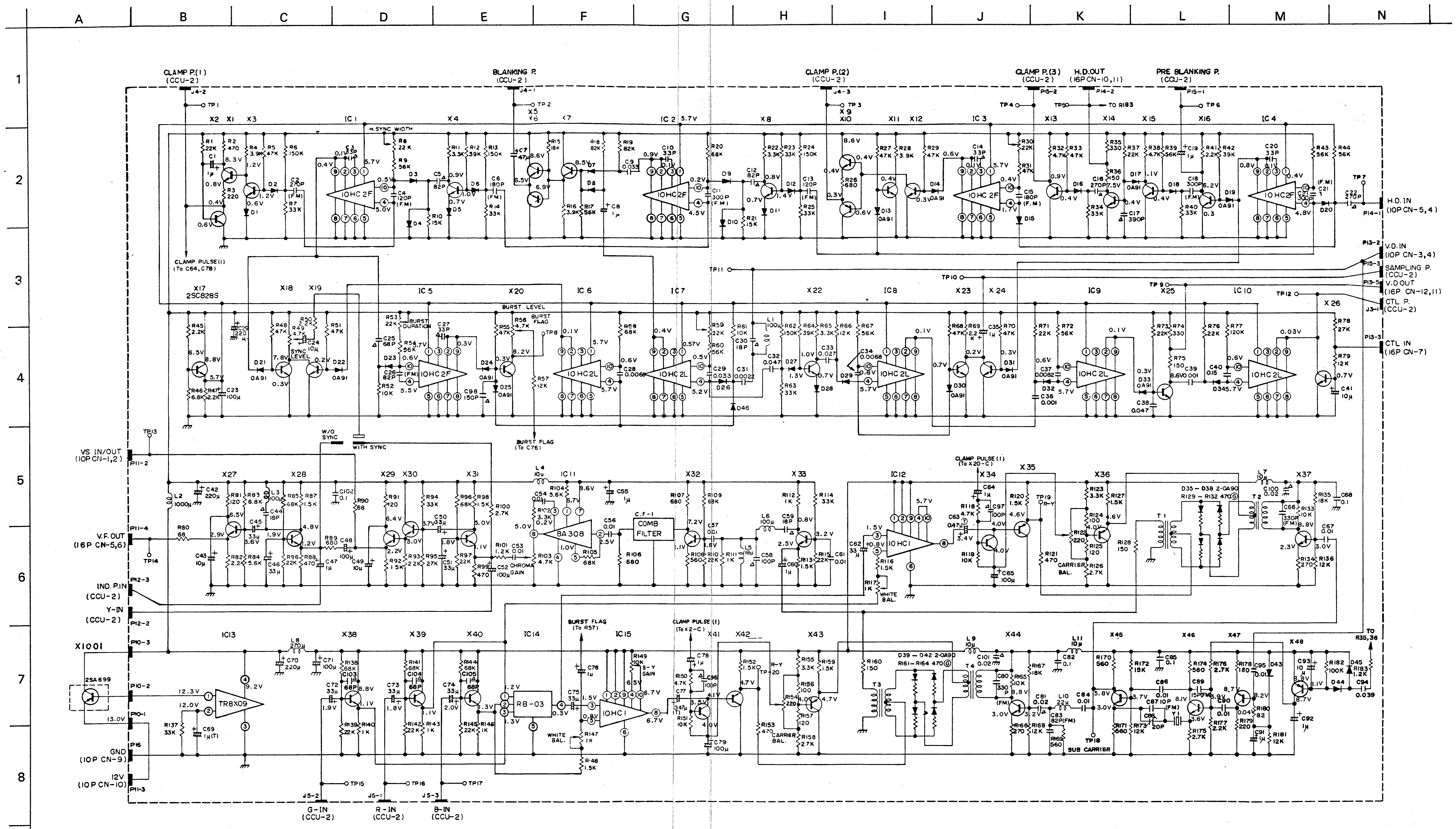

A
B
C
D
E
F
1
2
3
4
5
6
C13 153 630
C12 153 630
C11 153 630
D6 SM-1-12
D5
D7 SM-1-12
C10 153 630
C16 104 400
C15 104 400
R11 10M
R10 1M
C14 104 400
C18 4.7 160
T1 PU42861
D8 SM-1-12
D9 SM-1-12
D11 SM-1-12
R12 1K
C17 4.7 160
D10 SM-1-12
P 4
X4 2SC1384R
D3 1S2473VE
X5 2SC1384R
P 5
C21 47 50
C19 220 63
D12 SM-1-12
C5 4.7 25
0.4V
D14 V11L
D15 V11L
C22 153 630
R9 150
D2 1S2473VE
D4
C6 4.7 25
R7 4.7K
P 1
D16 V11L
R3 470
C4 472
C2 330
R5 820
C1
R2 470
R6 4.7K
C23 153 630
D13 V11L
R17 1.2M
R15 2.2M
R4 820
C20 160
C24 104 400
L1
C8 47 10
D1 1S2473VE
C3 472
X1 2SC829C
R14 100K
R16 2.7K
R1 2.2K
2SA564
R13 1M
P 2
PU42860
C7 47 10
P 3

NOTE: 1. All reference numbers of components in this diagram are in 600 series.
2. All voltages are dc-measured with a VTVM when operating camera normally.


7
8
9
39.0
R6 22M
R5 100K
R1 100
R2 1K
C1 104
R4 1K
D2
D1
X1
C3 50
C2 10 16
R3 1M

NOTE: •1. All reference numbers of components in this diagram are in 700 series.
2. A voltage is dc-measured with a VTVM when operating camera normally.

7-10 CCU-1 SCHEMATIC DIAGRAM

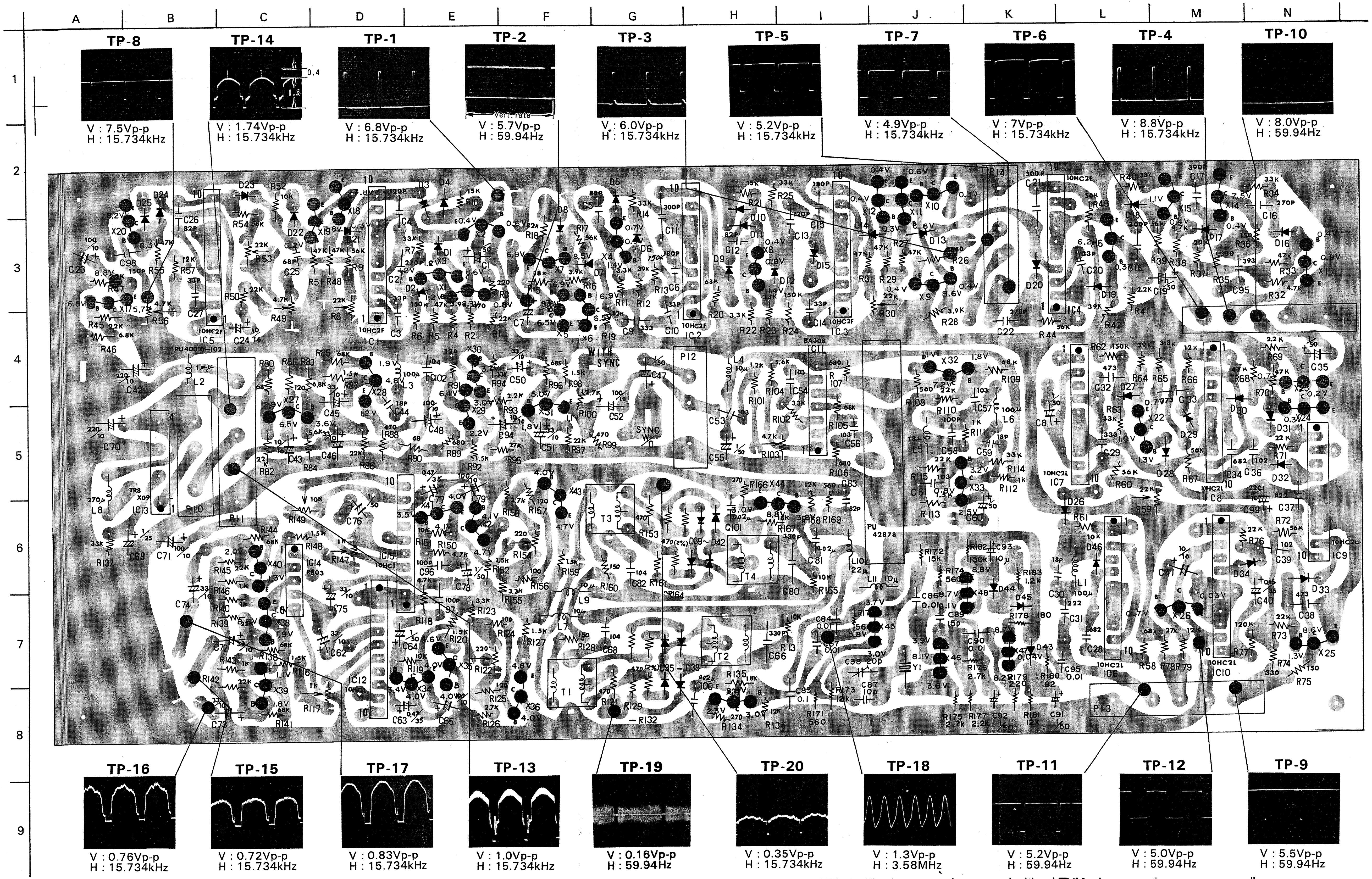

A
B
C
D
E
F
G
H
I
J
K
L
M
N
1
2
3
4
5
6
7
8
CLAMP P.(1) (CCU-2)
BLANKING P. (CCU-2)
CLAMP P.(2) (CCU-2)
CLAMP P.(3) (CCU-2)
H.D.OUT (16P CN-10,11)
PRE BLANKING P. (CCU-2)
H.D. IN (10P CN-5,4)
V.D. IN (10P CN-3,4)
SAMPLING P. (CCU-2)
V.D.OUT (16P CN-12,11)
CTL P. (CCU-2)
CTL IN (16P CN-7)
CLAMP PULSE(1) (To C64,C78)
H.SYNC WIDTH
BURST LEVEL
BURST DURATION
BURST FLAG
SYNC LEVEL
BURST FLAG (To C76)
W/O SYNC
WITH SYNC
VS IN/OUT (10P CN-1,2)
V.F. OUT (16P CN-5,6)
IND. P.IN (CCU-2)
Y-IN (CCU-2)
X1001
2SA699
GND (10P CN-9)
12V (10P CN-10)
TR8X09
BA308
COMB FILTER
CHROMA GAIN
WHITE BAL.
CARRIER BAL.
R-Y
B-Y GAIN
RB-03
SUB CARRIER
D35 – D38 2-0A90 R129 – R132 470Ω
D39 – D42 2-0A90 R161 – R164 470Ω
G-IN (CCU-2)
R-IN (CCU-2)
B-IN (CCU-2)
TO R35,36
2SC828S

NOTE: 1. Unless otherwise specified;
All PNP transistors are 2SA564S.
All NPN transistors are 2SC829C.
All diodes are 1S2473VE.
All resistance values are in ohms, ¼W, ±10%.

All capacitance values are in µF.
Electrolytic Capacitor
(T) Tantalum Capacitor
(FM) Film Mica Capacitor
Δ Ceramic Capacitor
Mylar Capacitor

2. All voltages are dc-measured with a VTVM when operating camera normally.

7-11 CCU-1 CIRCUIT BOARD



TP-8
V : 7.5Vp-p
H : 15.734kHz

TP-14
V : 1.74Vp-p
H : 15.734kHz

TP-1
V : 6.8Vp-p
H : 15.734kHz

TP-2
V : 5.7Vp-p
H : 59.94Hz

TP-3
V : 6.0Vp-p
H : 15.734kHz

TP-5
V : 5.2Vp-p
H : 15.734kHz

TP-7
V : 4.9Vp-p
H : 15.734kHz

TP-6
V : 7Vp-p
H : 15.734kHz

TP-4
V : 8.8Vp-p
H : 15.734kHz

TP-10
V : 8.0Vp-p
H : 59.94Hz

TP-16
V : 0.76Vp-p
H : 15.734kHz

TP-15
V : 0.72Vp-p
H : 15.734kHz

TP-17
V : 0.83Vp-p
H : 15.734kHz

TP-13
V : 1.0Vp-p
H : 15.734kHz

TP-19
V : 0.16Vp-p
H : 59.94Hz

TP-20
V : 0.35Vp-p
H : 15.734kHz

TP-18
V : 1.3Vp-p
H : 3.58MHz

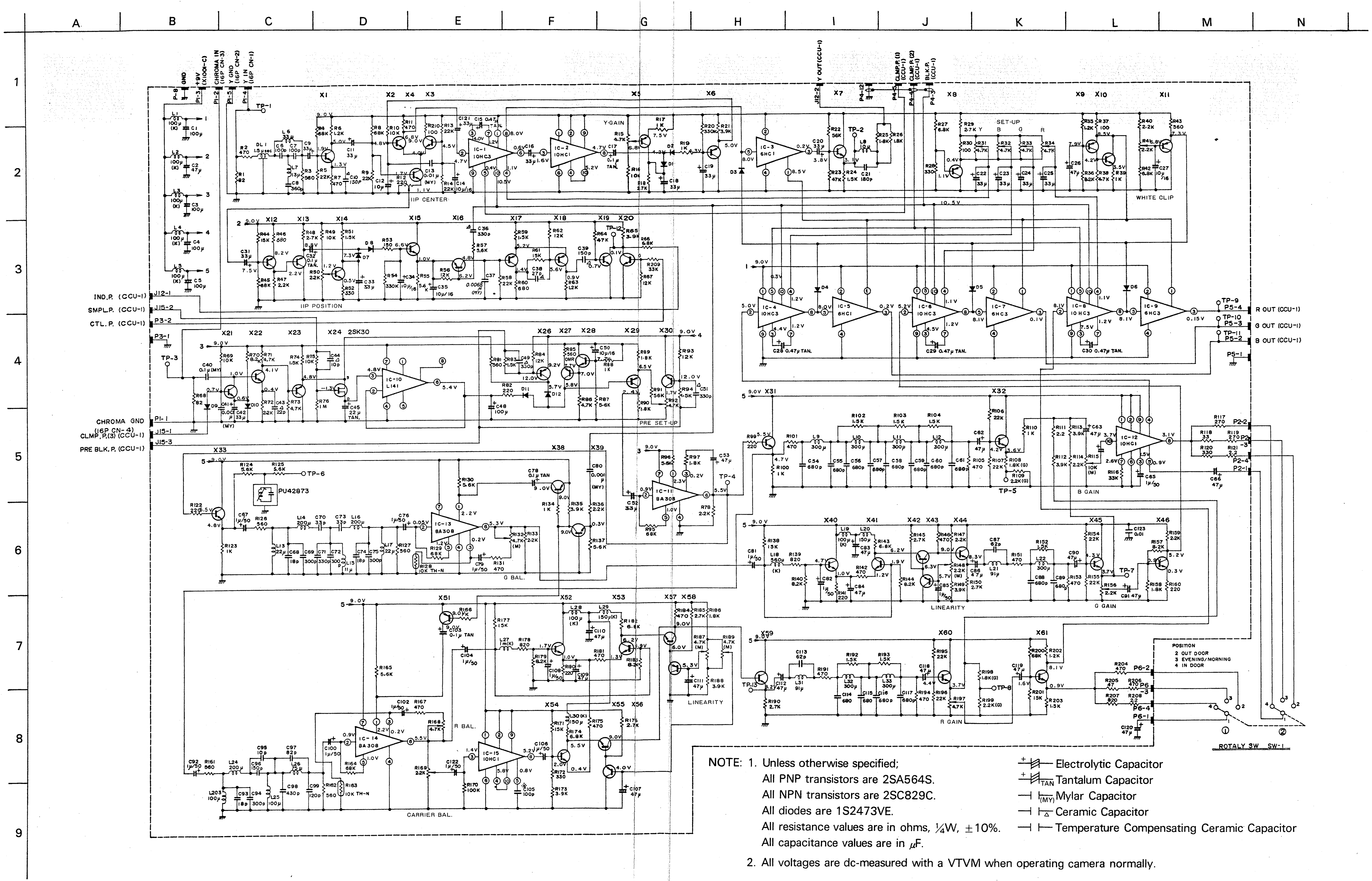
TP-11
V : 5.2Vp-p
H : 59.94Hz

TP-12
V : 5.0Vp-p
H : 59.94Hz

TP-9
V : 5.5Vp-p
H : 59.94Hz

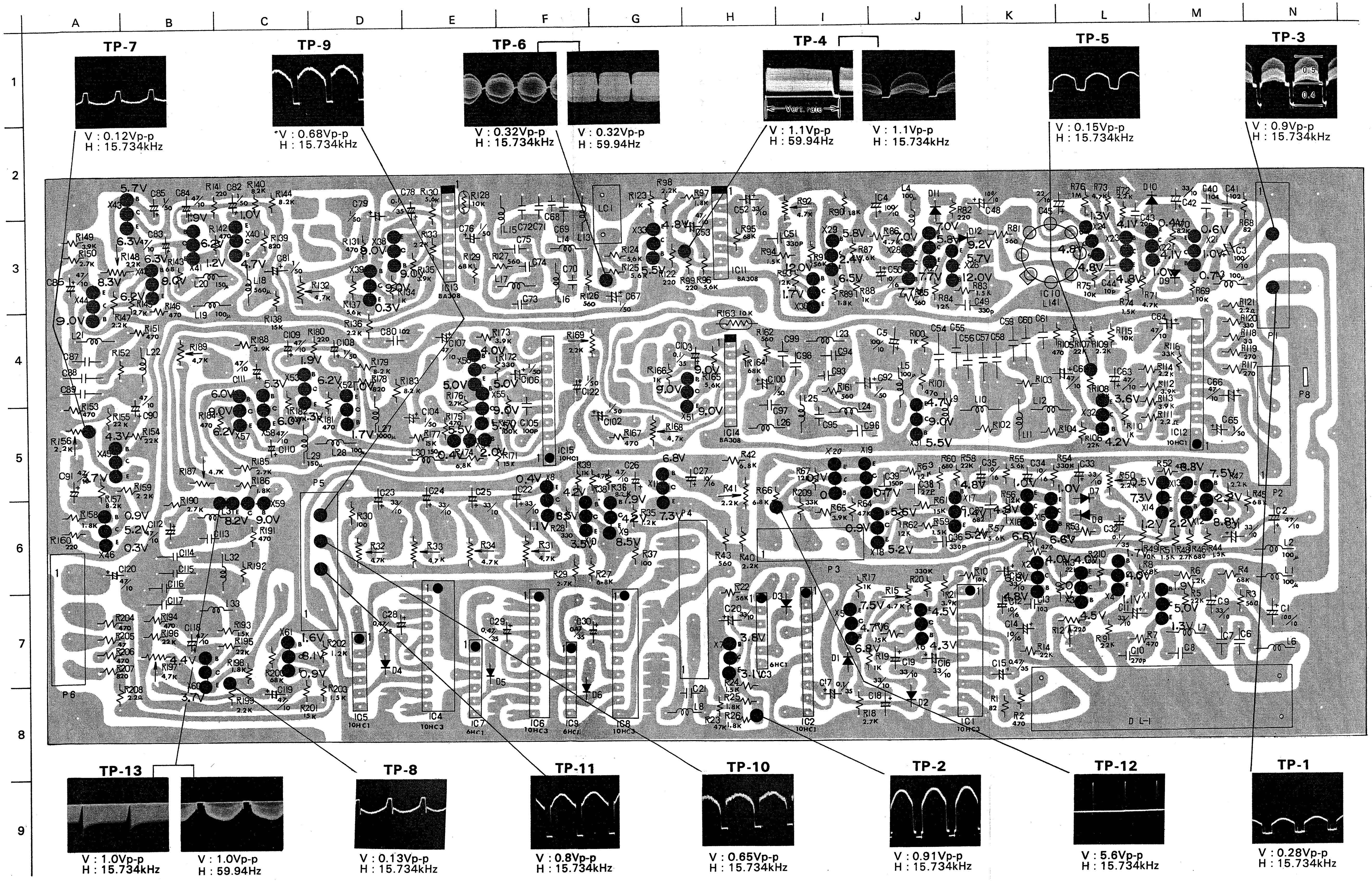
NOTE: 1. All voltages are dc-measured with a VTVM when operating camera normally.
2. All waveforms apply when using the White Field, Chart No. 2, as the subject.

7-12 CCU-2 SCHEMATIC DIAGRAM


A
B
C
D
E
F
G
H
I
J
K
L
M
N
1
2
3
4
5
6
7
8
9
P-8 GND
P1-3 +9V (X1001-C)
P1-2 CHROMA IN (16P CN-3)
P1-5 Y GND (16P CN-2)
P1-4 Y IN (16P CN-1)
J12-2 Y OUT (CCU-1)
P4-1
P4-2 CLMP.P. (1) (CCU-1)
P4-4 CLMP.P. (2) (CCU-1)
P4-3 BLK.P. (CCU-1)
TP-1
TP-2
TP-3
TP-4
TP-5
TP-6
TP-7
TP-8
TP-9 P5-4 R OUT (CCU-1)
TP-10 P5-3 G OUT (CCU-1)
TP-11 P5-2 B OUT (CCU-1)
P5-1
TP-12
TP-13
IND.P. (CCU-1) J12-1
SMPL.P. (CCU-1) J15-2
CTL. P. (CCU-1) P3-2
P3-1
CHROMA GND P1-1
(16P CN-4) CLMP.P.(3) (CCU-1) J15-1
PRE BLK.P. (CCU-1) J15-3
IC-1 10HC3
IC-2 10HC1
IC-3 6HC1
IC-4 10HC3
IC-5 6HC1
IC-6 10HC3
IC-7 6HC3
IC-8 10HC3
IC-9 6HC3
IC-10 L141
IC-11 BA308
IC-12 10HC1
IC-13 BA308
IC-14 BA308
IC-15 10HC1
Y-GAIN
IIP CENTER
IIP POSITION
SET-UP
WHITE CLIP
PRE SET-UP
B GAIN
G BAL.
LINEARITY
G GAIN
R BAL.
R GAIN
CARRIER BAL.
PU42873
X24 2SK30
POSITION
2 OUT DOOR
3 EVENING/MORNING
4 IN DOOR
P2-1
P2-2
P2-3
P2-4
P6-1
P6-2
P6-3
P6-4
ROTALY SW SW-1

NOTE: 1. Unless otherwise specified;
All PNP transistors are 2SA564S.
All NPN transistors are 2SC829C.
All diodes are 1S2473VE.
All resistance values are in ohms, ¼W, ±10%.
All capacitance values are in μF.
2. All voltages are dc-measured with a VTVM when operating camera normally.

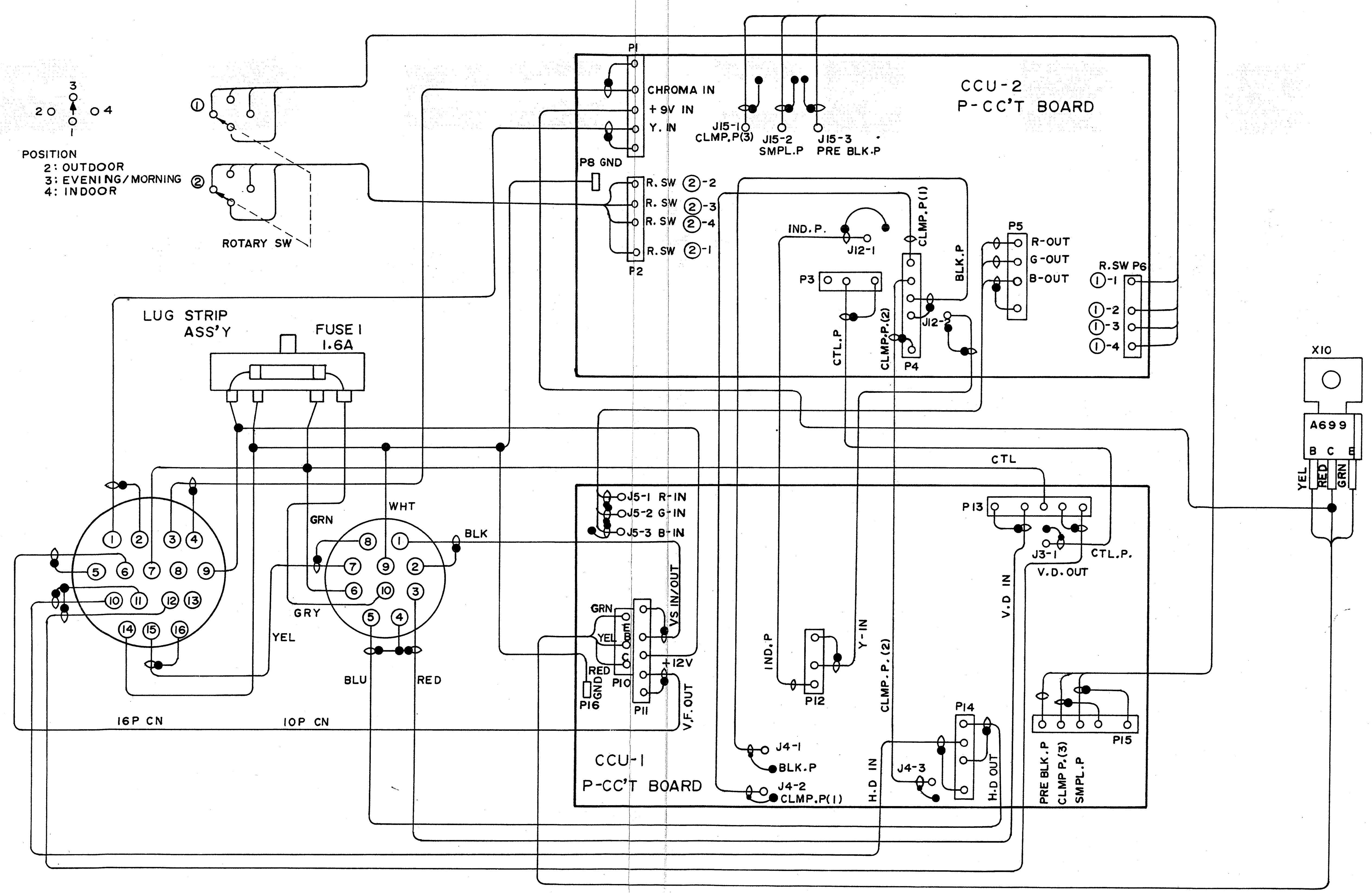
Electrolytic Capacitor
TAN Tantalum Capacitor
(MY) Mylar Capacitor
△ Ceramic Capacitor
Temperature Compensating Ceramic Capacitor


A
B
C
D
E
F
G
H
I
J
K
L
M
N
1
2
3
4
5
6
7
8
9
TP-7
V : 0.12Vp-p
H : 15.734kHz
TP-9
V : 0.68Vp-p
H : 15.734kHz
TP-6
V : 0.32Vp-p
H : 15.734kHz
V : 0.32Vp-p
H : 59.94Hz
TP-4
Vert. rate
V : 1.1Vp-p
H : 59.94Hz
V : 1.1Vp-p
H : 15.734kHz
TP-5
V : 0.15Vp-p
H : 15.734kHz
TP-3
0.5
0.4
V : 0.9Vp-p
H : 15.734kHz
TP-13
V : 1.0Vp-p
H : 15.734kHz
V : 1.0Vp-p
H : 59.94Hz
TP-8
V : 0.13Vp-p
H : 15.734kHz
TP-11
V : 0.8Vp-p
H : 15.734kHz
TP-10
V : 0.65Vp-p
H : 15.734kHz
TP-2
V : 0.91Vp-p
H : 15.734kHz
TP-12
V : 5.6Vp-p
H : 15.734kHz
TP-1
V : 0.28Vp-p
H : 15.734kHz

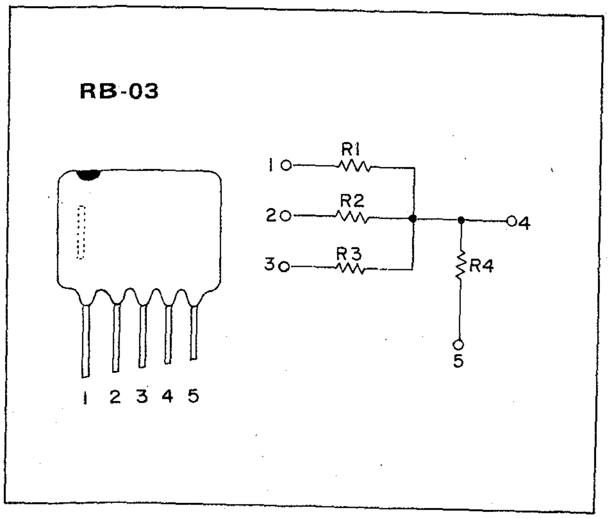
NOTE: 1. All voltages are dc-measured with a VTVM when operating camera normally.

2. All waveforms apply when using the White Field, Chart No. 2, as the subject.

7-14 CCU OVERALL WIRING DIAGRAM

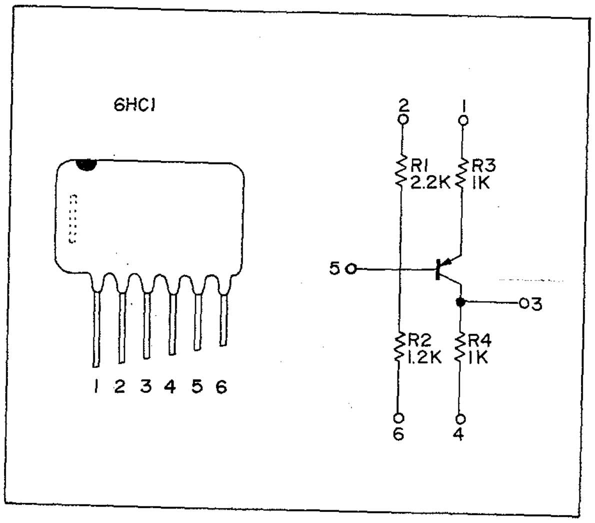

3
2
4
1
POSITION
2: OUTDOOR
3: EVENING/MORNING
4: INDOOR
①
②
ROTARY SW
P1
CHROMA IN
+9V IN
Y. IN
P8 GND
R. SW ②-2
R. SW ②-3
R. SW ②-4
R. SW ②-1
P2
J15-1
CLMP.P(3)
J15-2
SMPL.P
J15-3
PRE BLK.P
CCU-2
P-CC'T BOARD
IND. P.
J12-1
CLMP.P(1)
BLK.P
P3
CTL.P
CLMP.P.(2)
J12-2
P4
P5
R-OUT
G-OUT
B-OUT
R.SW P6
①-1
①-2
①-3
①-4
X10
A699
B C E
YEL
RED
GRN
LUG STRIP
ASS'Y
FUSE 1
1.6A
WHT
BLK
GRN
GRY
YEL
BLU
RED
16P CN
10P CN
J5-1 R-IN
J5-2 G-IN
J5-3 B-IN
VS IN/OUT
GRN
YEL
RED
GND
P16
P10
P11
+12V
V.F. OUT
IND.P
P12
Y-IN
CLMP. P. (2)
V.D IN
CTL
P13
J3-1
CTL.P.
V.D. OUT
P14
P15
J4-1
BLK.P
J4-2
CLMP.P(1)
H.D IN
J4-3
H.D OUT
PRE BLK.P
CLMP P.(3)
SMPL.P
CCU-1
P-CC'T BOARD

7-15 SCHEMATIC DIAGRAMS OF IC's



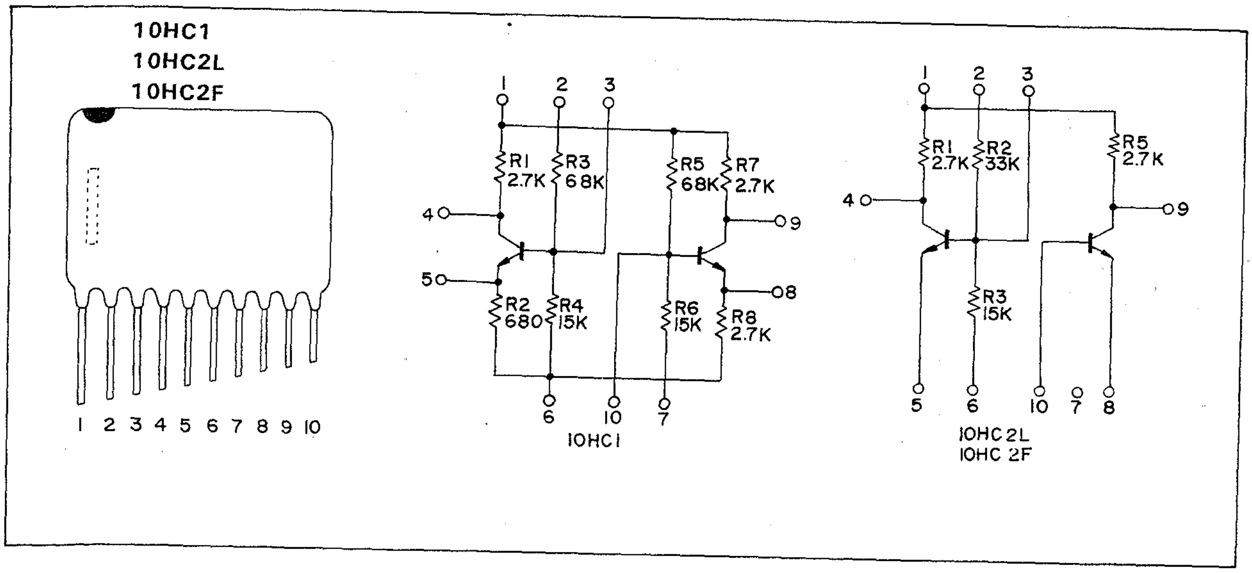
RB-03

1 2 3 4 5
1
2
3
R1
R2
R3
4
R4
5



6HC1

1 2 3 4 5 6
2
1
R1 2.2K
R3 1K
5
3
R2 1.2K
R4 1K
6
4

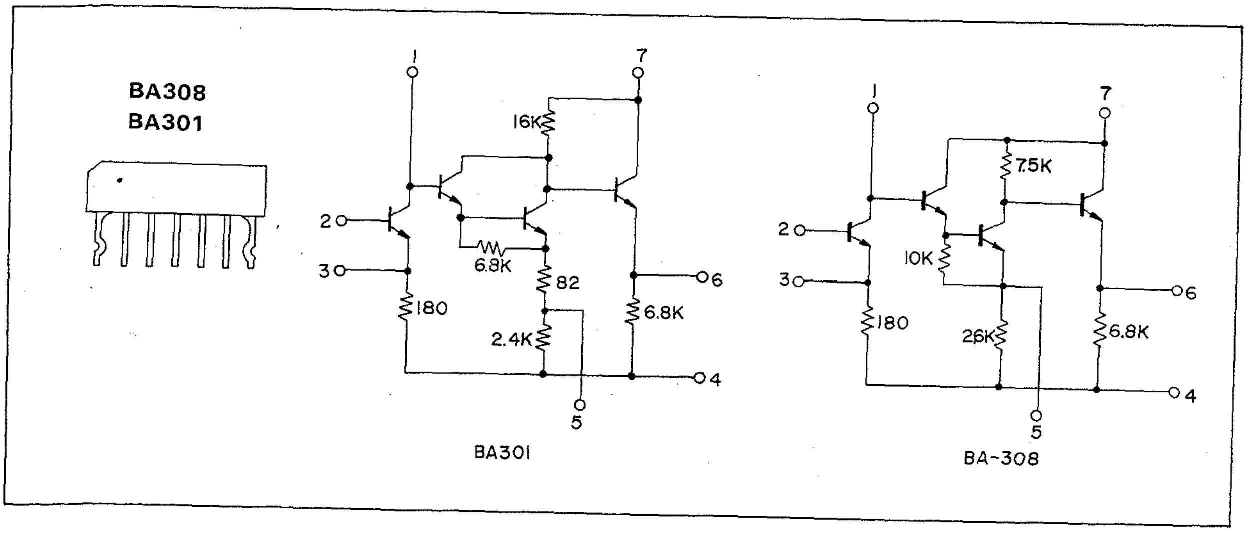


10HC1
10HC2L
10HC2F

1 2 3 4 5 6 7 8 9 10
1
2
3
R1 2.7K
R3 68K
R5 68K
R7 2.7K
4
9
5
8
R2 680
R4 15K
R6 15K
R8 2.7K
6
10
7
1
2
3
R1 2.7K
R2 33K
R5 2.7K
4
9
R3 15K
5
6
10
7
8

10HC1

10HC2L
10HC2F



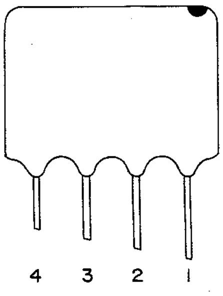
BA308
BA301

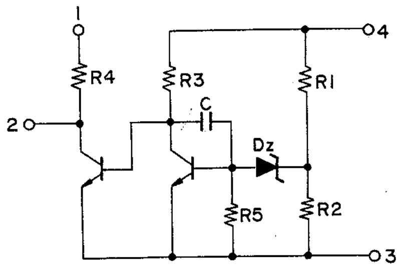
1
7
16K
2
3
6.8K
82
180
2.4K
6.8K
6
4
5
1
7
7.5K
2
10K
3
180
26K
6.8K
6
4
5

BA301

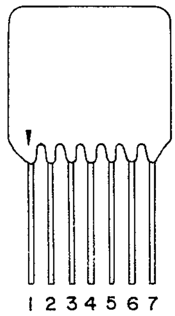
BA-308

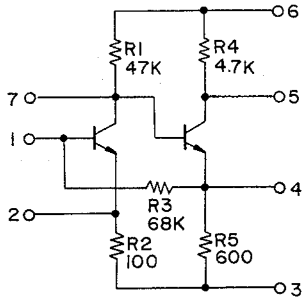
TR8X09



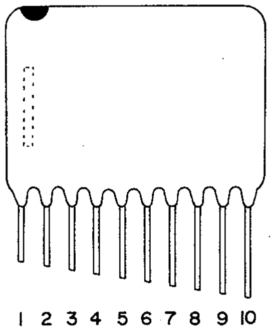

1
R4
2
R3
C
R1
4
Dz
R5
R2
3

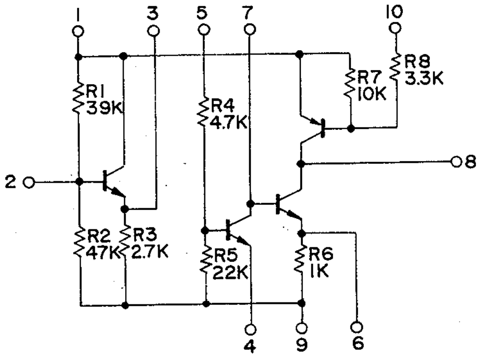
D2216



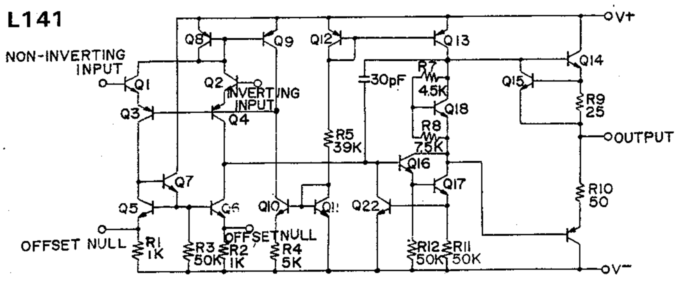

6
R1
47K
R4
4.7K
7
5
1
R3
68K
4
2
R2
100
R5
600
3

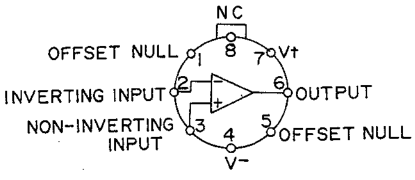
10HC3


1 2 3 4 5 6 7 8 9 10


1
3
5
7
10
R1
39K
R7
10K
R8
3.3K
R4
4.7K
2
8
R2
47K
R3
2.7K
R5
22K
R6
1K
4
9
6

L141


NON-INVERTING INPUT
Q1
Q2
Q3
Q4
Q5
Q6
Q7
Q8
Q9
Q10
Q11
Q12
Q13
Q14
Q15
Q16
Q17
Q18
Q22
INVERTING INPUT
OFFSET NULL
R1
1K
R3
50K
R2
1K
OFFSET NULL
R4
5K
R5
39K
30pF
R7
4.5K
R8
7.5K
R12
50K
R11
50K
R9
25
R10
50
V+
OUTPUT
V−


NC
8
OFFSET NULL
1
7
V+
INVERTING INPUT
2
6
OUTPUT
NON-INVERTING INPUT
3
4
5
OFFSET NULL
V−

SECTION 8
ELECTRICAL PARTS LIST

Abbreviations in this list are as follows:

RESISTORS – All resistance values are in ohms (Ω).

K : 1,000
M : 1,000,000
CR : Carbon Resistor
Comp. R : Composition Resistor
WR : Wire Wound Resistor
OMR : Oxide Metal Film Resistor
VR : Variable Resistor
MFR : Metal Film Resistor

CAPACITORS – All capacitance values are in μF, unless otherwise indicated.

P : μμF
C Cap : Ceramic Capacitor
PS Cap : Polystyrol Capacitor
MY Cap : Mylar Capacitor
MP Cap : Metalized Paper Capacitor
PC Cap : Polycarbonate Capacitor
E Cap : Electrolytic Capacitor
PP Cap : Poly Pro Capacitor
MM Cap : Metalized Mylar Capacitor
T Cap : Tantalum Capacitor
FM Cap : Film Mica Capacitor

Tolerances of resistors or capacitors are as follows:

M : ± 20%
K : ± 10%
J : ± 5%
G : ± 2%

8-1 MAIN AMPLIFIER CIRCUIT BOARD ASS'Y

Symbol No.	Part No.	Part Name	Description
	PU42888A	Main Amp PCB Ass'y	
	PU20316	PCB	
X301	2SA564Q	Transistor	
X302	"	"	
X303	2SC829C	"	
X304	2SC1384Q	"	
X305	2SC458LGC	"	(or 2SC458LGB)
X306	2SC829C	"	
X307	2SC1383Q	"	
X308	2SA683Q	"	
X309	2SC1383Q	"	
X310	2SA564Q	"	
X311	2SC829C	"	
X312	"	"	
X313	"	"	
X314	"	"	
X315	2SA564Q	"	
X316	"	"	
X317	"	"	
X318	2SC829C	"	
X319	"	"	
X320	"	"	
X321	2SC1383Q	"	
X322	2SA683Q	"	
X323	2SC829C	"	
X324	2SC499Y	"	
X325	"	"	
X326	2SA564Q	"	
X327	2SA777	"	
X328	2SC829C	"	
X329	"	"	
X330	2SA684Q	"	
X331	"	"	
X332	2SC829C	"	
X333	"	"	
X334	"	"	
X335	2SA564Q	"	
X336	2SC829C	"	
X337	2SA564Q	"	
X338	2SC829C	"	
X339	2SA564Q	"	
X340	2SC829C	"	
X341	2SA564Q	"	
X342	2SC829C	"	
X343	2SA564Q	"	
X344	2SC829C	"	
X345	2SA564Q	"	
X346	2SC829C	"	
X347	2SA561Y	"	
X348	2SA564Q	"	
X349	"	"	
X350	2SC828T	"	
X351	2SC829C	"	
X352	"	"	
X353	"	"	
X354	"	"	
X355	2SC1384Q	"	
X356	2SC829C	"	
X357	2SA1383Q	"	
X358	2SA683Q	"	

Symbol No.	Part No.	Part Name	Description
X359	2SC829C	Transistor	
X360	2SC484Y	"	
IC1	10HC1	Integrated Circuit	
IC2	D2216	"	
IC3	"	"	
IC4	BA301	"	
IC5	TR8X09	"	
D301	IS2473VE	Diode	
D302	SD21	"	
D303	MA26	"	
D304	"	"	
D305			
D306		"	
D307	MA26	Diode	
D308	"	"	
D309	IS2473VE	"	
D310	"	"	
D311	"	"	
D312	"	"	
D313	"	"	
D314	"	"	
D315	"	"	
D316	IN60	"	
D317	IN60	"	
D318	IS2473VE	"	
D319	MA26	"	
D320	MA26	"	
D321	SD21	"	
D322	MA26	"	
D323	MA26	"	
D324	OA91	"	
T301	PU42867	Coil	
T302	PU42863	Linearity Transformer	
T303	A42055	OSC Transformer	
T304	"	"	
L301	A 04096-330	Peaking Coil	
L302	PU42864	Choke Coil	
L303	PU40010-910	Coil	
L304	PU42866	"	
L305	A04096-47	Peaking Coil	
L306	PU42868	Coil	
L307	PU40010-181	"	
TH401	ERT-D2FHL103S	Thermistor	
TH402	ERT-D2FHL202S	"	
TH403	ERT-D2FHL104S	"	
R301	QRD143K-103	CR	10K ¼W,K
R302	" -102	"	1K "
R303	" -223	"	22K "
R304	" -182	"	1.8K "
R305	" -392	"	3.9K "
R306	" -821	"	820 "
R307	" -681	"	680 "
R308	" -681	"	680 "
R309	" -681	"	680 "
R310	E03511-102	VR	1K
R311	QRD143K-271	CR	270 ¼W,K
R312	" -271	"	270 "

Symbol No.	Part No.	Part Name	Description
R313	QRD143K-681	CR	680 ¼W,K
R314	" -681	"	680 "
R315	E03511-102	VR	1K
R316	QRD143K-681	CR	680 ¼W,K
R317	E03511-102	VR	1K
R318	QRD143K-124	CR	120K ¼W,K
R319	" -223	"	22K "
R320	" -101	"	100 "
R321	" -103	"	10K "
R322	" -272	"	2.7K "
R323	" -222	"	2.2K "
R324	" -183	"	18K "
R325	" -562	"	5.6K "
R326	" -102	"	1K "
R327	" -150	"	15 "
R328	" -821	"	820 "
R329	" -4R7	"	4.7 "
R330	" -4R7	"	4.7 "
R331	E03511-101	VR	100
R332	QRW125K-R47	WR	0.47 ½W,K
R333	QRD143K-470	CR	47 ¼W,K
R334	" -182	"	1.8K "
R335	" -222	"	2.2K "
R336	E03511-222	VR	2.2K
R337	QRD143K-561	CR	560 ¼W,K
R338	" -332	"	3.3K "
R339	" -333	"	33K "
R340	QVP4A0B-103	VR	10K
R341	QRD143K-181	CR	180 ¼W,K
R342	" -103	"	10K "
R343	" -222	"	2.2K "
R344	" -102	"	1K "
R345	" -103	"	10K "
R346	" -272	"	2.7K "
R347	E03511-472	VR	4.7K
R348	QRD143K-471	CR	470 ¼W,K
R349	" -472	"	4.7K "
R350	E03511-222	VR	2.2K
R351	QRD143K-221	CR	220 ¼W,K
R352	" -562	"	5.6K "
R353	" -223	"	22K "
R354	" -222	"	2.2K "
R355	" -391	"	390 "
R356	" -100	"	10Q "
R357	" -562	"	5.6K "
R358	" -273	"	27K "
R359	" -821	"	820 "
R360	" -561	"	560 "
R361	" -470	"	47 "
R362	" -151	"	150 "
R363	" -100	"	10 "
R364	" -100	"	10 "
R365	" -102	"	1K "
R366	" -102	"	1K "
R367	E03511-222	VR	2.2K
R368	QRD143K-102	CR	1K ¼W,K
R369	" -122	"	1.2K "
R370	" -220	VR	22
R371	" -102	CR	1K ¼W,K
R372	" -102	"	1K "
R373	E03511-222	VR	2,2K
R374	QRD143K-102	CR	1K ¼W,K

Symbol No.	Part No.	Part Name	Description
R375	QRD143K-122	CR	1.2K ¼W,K
R376	E03511-101	VR	100
R377	QRD143K-472	CR	4.7K ¼W,K
R378	" -273	"	27K "
R379	" -392	"	3.9K "
R380	" -222	"	2.2K "
R381	" -271	"	270 "
R382	" -102	"	1K "
R383	" -103	"	10K "
R384	" -102	"	1K "
R385	" -103	"	10K "
R386	" -332	"	3.3K "
R387	" -332	"	3.3K "
R388	" -183	"	18K "
R389	E03511-223	VR	22K
R390	" -223	"	22K
R391	QRD143K-104	CR	100K ¼W,K
R392	" -102	"	1K "
R393	" -102	"	1K "
R394	" -392	"	3.9K "
R395	" -102	"	1K "
R396	" -152	"	1.5K "
R397	" -102	"	1K "
R398	" -104	"	100K "
R399	" -683	"	68K "
R400	" -683	"	68K "
R401	" -102	"	1K "
R402	" -392	"	3.9K "
R403	" -152	"	1.5K "
R404	" -102	"	1K "
R405	" -102	"	1K "
R406	" -102	"	1K "
R407	" -104	"	100K "
R408	" -394	"	390K "
R409	QVP4A0B-225	VR	2.2M
R410	" -225	"	2.2M
R411	PU42871-273	OMR	27K ¼W,J
R412	E03511-683	VR	68K
R413	" -683	"	68K
R414	PU42871-273	OMR	27K ¼W, J
R145	QRD143K-123	CR	12K ¼W,K
R146	" -472	"	4.7K "
R417	" -472	"	4.7K "
R418	QVP4A0B-103	VR	10K
R419	" -103	"	10K
R420	QRD143K-472	CR	4.7K ¼W,K
R421	" -472	"	4.7K "
R422	QVP4A0B-103	VR	10K
R423	" -103	"	10K
R424	QRD143K-471	CR	470 ¼W,K
R425	—		— "
R426	QRD143K-153	CR	15K ¼W K
R427	" -682	"	6.8K "
R428	" -102	"	1K "
R429	" -102	"	1K "
R430	QVP4A0B-473	VR	47K
R431	" -473	"	47K
R432	" -473	"	47K
R433	" -473	"	47K
R434	QRD143K-104	CR	100K ¼W,K
R435	" -274	"	270K "
R436	" -473	"	47K "

Symbol No.	Part No.	Part Name	Description
R437	QRD143K-393	CR	39K ¼W,K
R438	" -472	"	4.7K "
R439	" -472	"	4.7K "
R440	" -682	"	6.8K "
R441	" -273	"	27K "
R442	" -102	"	1K "
R443	" -562	"	5.6K "
R444	" -561	"	560 "
R445	" -473	"	47K "
R446	" -103	"	10K "
R447	" -682	"	6.8K "
R448	" -102	"	1K "
R449	" -102	"	1K "
R450	QVP4A0B-473	VR	47K
R451	" -473	"	47K
R452	" -473	"	47K
R453	" -473	"	47K
R454	QRD143K-394	CR	390K ¼W,K
R455	" -224	"	220K "
R456	" -104	"	100K "
R457	" -154	"	150K "
R458	" -472	"	4.7K "
R459	" -183	"	18K "
R460	QVP4A0B-331	VR	330
R461	QRD143K-151	CR	150 ¼W,K
R462	" -151	"	150 "
R463	" -153	"	15K "
R464	" -472	"	4.7K "
R465	" -101	"	100 "
R466	" -102	"	1K "
R467	" -101	"	100 "
R468	" -561	"	560 "
R469	" -123	"	12K "
R470	" -274	"	270K "
R471	" -181	"	180 "
R472	" -472	"	4.7K "
R473	" -182	"	1.8K "
R474	" -105	"	1M "
R475	" -103	"	10K "
R476	" -101	"	100 "
R477	" -392	"	3.9K "
R478	" -184	"	180K "
R479	" -392	"	3.9K "
R480	" -223	"	22K "
R481	" -223	"	22K "
R482	" -123	"	12K "
R483	" -223	"	22K "
R484	" -222	"	2.2K "
R485	" -392	"	3.9K "
R486	" -821	"	820 "
R487	E03511-222	VR	2.2K
R488	QRD143K-152	CR	1.5K ¼W,K
R489	" -103	"	10K "
R490	" -101	"	100 "
R491	" -153	"	15K "
R492	" -562	"	5.6K "
R493	" -223	"	22K "
R494	" -222	"	2.2K "
R495	" -181	"	180 "
R496	" -472	"	4.7K "
R497	" -222	"	2.2K "
R498	" -124	"	120K "

Symbol No	Part No.	Part Name	Description
R499	QRD143K-183	CR	18K ¼W,K
R500	″ -821	″	820 ″
R501	″ -103	″	10K ″
R502	E03511-104	VR	100K
R503	QRD143K-183	CR	18K ¼W,K
R504	″ -273	″	27K ″
R505	″ -103	″	10K ″
R506	″ -392	″	3.9K ″
R507	″ -152	″	1.5K ″
R508	″ -152	″	1.5K ″
R509	″ -221	″	220 ″
R510	″ -6R8	″	6.8 ″
R511	″ -822	″	8.2K ″
R512	″ -151	″	150 ″
R513	″ -153	″	15K ″
R514	″ -152	″	1.5K ″
R515	″ -223	″	22K ″
R516	″ -100	″	10 ″
R517	″ -100	″	10 ″
R518	″ -470	″	47 ″
R519	″ -101	″	100 ″
R520	″ -820	″	82 ″
R521	″ -153	″	15K ″
R522	″ -101	″	100 ″
R523	″ -104	″	100K ″
R524	″ -151	″	150 ″
R525	″ -683	″	68K ″
R526	″ -151	″	150 ″
R527	″ -273	″	27K ″
R528	″ -472	″	4.7K ″
R529	″ -681	″	680 ″
R530	″ -333	″	33K ″
R531			
R532			
R533	″ -102	″	1K ″
R534	″ -822	″	8.2K ″
R535			
R536	″ -103	″	10K ″
R537	″ -333	″	33K ″
R538	″ -394	″	390K ″
C301	QEW41HA-105	E Cap	1μ 50V
C302	QCS11HJ-121	C Cap	120p ″
C303	QEW41CA-106	E Cap	10μ 16V
C304	QCS11HJ-101	C Cap	100p 50V
C305	QEW41CA-106	E Cap	10μ 16V
C306	QFM41HK-682	MY Cap	00068 50V
C307	QEW41AA-227	E Cap	220μ 10V
C308	″ -107	″	100μ ″
C309	″ -227	″	220μ ″
C310	″ -227	″	220μ ″
C311	″ -227	″	220μ ″
C312	″ -105	″	1μ 50V
C313	″ -476	″	47μ 10V
C314	QFM41HK-103	MY Cap	0.01μ 50V
C315	QEW41CA-106	E Cap	10μ 16V
C316	QEW41AA-476	″	47μ 10V
C317	QCS11HJ-2R0	C Cap	2p 50V
C318	QEW41CA-106	E Cap	10μ 16V
C319	QEW40JA227	″	220μ 6.3V
C320	QEW40JA-107	″	100μ ″

Symbol No.	Part No.	Part Name	Description
C321	QEW41CA-106	E Cap	10μ 16V
C322	″ -106	″	10μ ″
C323	QEW40JA-227	″	220μ 6.3V
C324	QEW41CA-106	″	10μ 16V
C325	QEW40AA-476	″	47μ 10V
C326	PU42865	T Cap	10μ 16V
C327	PU42865	″	10μ ″
C328	QEW41AA-476	E Cap	47μ 10V
C329	QEW41CA-106	″	10μ 16V
C330	QEW40JA-107	″	100μ 6.3V
C331	″ -336	″	33μ ″
C332	QEW41AA-107	″	100μ 10V
C333	QEW40JA-477	″	470μ 6.3V
C334	″ -477	″	470μ ″
C335	″ -477	″	470μ ″
C336	″ -477	″	470μ ″
C337	QEW41HA-105	″	1μ 50V
C338	QFM41HK-223	My Cap	0.022μ ″
C339	QEW41HA-105	E Cap	1μ ″
C340	QEW41CA-106	″	10μ 16V
C341	QEW40JA-227	″	220μ 6.3V
C342	QFM41HK-223	MY Cap	0.022μ 50V
C343	QEW40JA-107	E Cap	100μ 6.3V
C344	QEW41HA-105	″	1μ 50V
C345	QEW41CA-106	″	10μ 16V
C346	QFM42AM-103	MY Cap	0.01μ 100V
C347	″ -103	″	0.01μ ″
C348	QEW41AA-476	E Cap	47μ 10V
C349	QEW41AA-476	″	47μ ″
C350	QEW42CA-105	″	1μ 160V
C351	QEW41HA-106	″	10μ 50V
C352			
C352			
C353	QEW41HA-106	″	10μ 50V
C354			
C355	QFM42AM-333	MY Cap	0.033μ 100V
C356	″ -333	″	0.033μ ″
C357	″ -333	″	0.033μ ″
C358	″ -333	″	0.033μ ″
C359	QEW41CA-106	E Cap	10μ 16V
C360	QEW41AA-476	″	47μ 10V
C361	QCS11HJ-391	C Cap	390p 50V
C362	QEW41HA-106	E Cap	10μ ″
C363	QCS11HJ-391	C Cap	390p ″
C364	QEW41AA-476	E Cap	47μ 10V
C365	QFM41HK-104	MY Cap	0.1μ 50V
C366	″ -102	″	0.001μ ″
C367	QCS11HJ-101	C Cap	100p ″
C368	QFM41HK-472	MY Cap	0.0047μ ″
C369	″ -472	″	0.0047μ ″
C370	″ -153	″	0.015μ ″
C371	″ -103	″	0.01μ ″
C372	″ -152	″	0.0015μ ″
C373	″ -473	″	0.047μ ″
C374	QEW41HA-105	E Cap	1μ ″
C375	QEW41EA-475	″	4.7μ ″
C376	QFM41HK-153	MY Cap	0.015μ ″
C377	″ -823	″	0.082μ ″
C378	″ -563	″	0.056μ ″
C379	″ -563	″	0.056μ ″
C380	″ -104	″	0.1μ ″
C381	″ -224	″	0.22μ ″

Symbol No.	Part No.	Part Name	Description
C382	PU41618-2	T Cap	4.7 16V
C383	" -2	"	4.7 "
C384	QEW41AA-476	E Cap	47 10V
C385	QEW41CA-106	"	10 16V
C386	QEW41AA-476	"	47 10V
C387	QEW40JA-227	"	220 6.3V
C388	QEW41AA-337	"	330 10V
C389	QEW41CA-106	"	10 16V
C390	QFM41HK-223	MY Cap	0.022 50V
C391	QEW41AA-107	E Cap	100 10V
C392	QEW41HA-105	"	1 50V
C393	QFM42AM-103	MY Cap	0.01 100V
C394	PU41618-4	T Cap	22 16V
C395	QEW41AA-227	E Cap	220 10V
C396	" -476	"	47 "
C397	PU41618-1	T Cap	1 25V
C398	QEW41CA-107	E Cap	100 16V
C399	QFM41HK-563	MY Cap	0.056 50V
C400	QEW41AA-476	E Cap	47 10V
C401	QEW41CA-106	"	10 16V
C402	QEW41HA-105	"	1 50V
C403	" -105	"	1 "
C404	" -105	"	1 "
C405	QFM41HK-103	MY Cap	0.01 50V
C406	" -103	"	0.01 "
C407	QEW41CA-106	E Cap	10 16V
C408	QCS11HJ-270	C Cap	27p 50V
C409	QEW41CA-106	E Cap	10 16V
C410	QEW41CA-106	"	10 "
C411	QEW41AA-336	"	33 10V
C412	QCS11HJ-680	C Cap	68p 50V
C413	QEW41CA-106	E Cap	10 16V
C414	" -106	"	10 "
C415	" -106	"	10 "
C416	PU41618-1	T Cap	1 25V
C417	"	"	1 "
C418	QEW41CA-106	E Cap	10 16V
C419	QCS11HJ-680	C Cap	68p 50V
C420	QFM41HK-472	MY Cap	0.0047 50V
C421	QEW41CA-106	E Cap	10 16V
C422	QFM41HK-104	MY Cap	0.1 50V
C423	QCS11HJ-330	C Cap	33p "
C424	QFM41HK-683	MY Cap	0.068 "
	PU40734	Test Point	
P 6	A74067-5X	Mini Plug	
P 7	" -4X	"	
P 8	" -5X	"	
P 9	" -5X	"	
P10	" -5X	"	
P11	" -5X	"	
P12	" -4X	"	
P13	" -5X	"	
P14	" -4X	"	
P15	" -4X	"	
P16	" -5X	"	
P17	" -5X	"	
P18	" -4X	"	
P19	" -5X	"	

8-2 LUMINANCE (Y) PRE-AMPLIFIER CIRCUIT BOARD ASS'Y

Symbol No.	Part No.	Part Name	Description
	PU42894A	Y Ch. Pre-amp. Ass'y	
	PU42886	Circuit Board	
X101	3SK28GR	FET	
X102	2SC829C	Transistor	
X103	"	"	
X104	"	"	
X105	2SA564Q	"	
X106	2SC829C	"	
L101	A04096-22	Peaking Coil	22μH
R101	QRD143K-105	C.R.	1M ¼W,K
R102	" -104	"	100K "
R103	" -105	"	1M "
R104	" -104	"	100K "
R105	" -820	"	82 "
R106	" -681	"	680 "
R107	" -121	"	120 "
R108	" -122	"	1.2K "
R109	" -393	"	39K "
R110	" -221	"	220 "
R111	" -222	"	2.2K "
R112	" -222	"	2.2K "
R113	" -152	"	1.5K "
R114	" -100	"	10 "
R115	" -152	"	1.5K "
R116	" -123	"	12K "
R117	" -123	"	12K "
R118	" -182	"	1.8K "
R119	" -391	"	390 "
R120	" -272	"	2.7K "
R121	" -681	"	680 "
R122	" -682	"	6.8K "
R123	" -182	"	1.8K "
R124	" -103	"	10K "
R125	" -822	"	8.2K "
R126	" -101	"	100 "
R127	" -102	"	1K "
R128	" -470	"	47 "
R129	" -272	"	2.7K "
C101	QFM41HK-333	MY Cap	0.033 50V
C102	" -683	"	0.068 "
C103	-683	"	0.068 "
C104	QEW41AA-107	E Cap	100 10V
C105	QEW41HA-105	"	1 50V
C106	QEW40JA-227	"	220 6.3V
C107	QEW41HA-105	"	1 50V
C108	QEW41AA-476	"	47 10V
C109	" -107	"	100 "
C110	QEW41CA-106	"	10 16V
C111	QCS11HJ-151	C Cap	150p 50V
C112	QEW41AA-336	E Cap	33 10V
C113	QCS11HJ-181	C Cap	180p 50V
C114	" -820	"	82p "
C115	QEW41CA-106	E Cap	10 16V
C116	QEW41AA-336	"	33 10V
C117	" -107	"	100 "
C118	" -107	"	100 "
C119			
C120	QCS11HJ-3R0	C Cap	3p 50V

Symbol No.	Part No.	Part Name	Description
J10	PU43192 A74069-5 PU42922B	Binder Mini Housing Sticker	

8-3 CHROMA PRE-AMPLIFIER CIRCUIT BOARD ASS'Y

Symbol No.	Part No.	Part Name	Description
	PU42887A	Color Ch. Pre-amp. Ass'y	
	PU42886	Circuit Board	
X201	3SK28GR	FET	
X202	2SC829C	Transistor	
X203	"	"	
X204	"	"	
X205	2SA564Q	"	
X206	2SC829C	"	
X207	2SK30-0	FET	
X208	"	"	
L201	A04096-150	Peaking Coil	
R201	QRD143K-105	C.R.	1M ¼W,K
R202	" -104	"	100K "
R203	" -105	"	1M "
R204	" -104	"	100K "
R205	" -820	"	82 "
R206	" -681	"	680 "
R207	" -121	"	120 "
R208	" -122	"	1.2K "
R209	" -393	"	39K "
R210	" -221	"	220 "
R211	" -222	"	2.2K "
R212	" -222	"	2.2K "
R213	" -152	"	1.5K "
R214	" -100	"	10 "
R215	" -152	"	1.5K "
R216	" -123	"	12K "
R217	" -123	"	12K "
R218	" -182	"	1.8K "
R219	" -391	"	390 "
R220	" -272	"	2.7K "
R221	" -681	"	680 "
R222	" -682	"	6.8K "
R223	" -182	"	1.8K "
R224	" -103	"	10K "
R225	" -822	"	8.2K "
R226	" -101	"	100 "
R227	" -102	"	1K "
R228	" -470	"	47 "
R229	" -272	"	2.7K "
R230	" -105	"	1M "
R231	" -102	"	1K "
C201	QFM41HK-333	MY Cap	0.033 50V
C202	" -683	"	0.068 "
C203	" -683	"	0.068 "
C204	QEW41AA-107	E Cap	100 10V
C205	QEW41HA-105	"	1 50V
C206	QEW40JA-227	"	220 6.3V
C207	QEW41HA-105	"	1 50V
C208	QEW41AA-476	"	47 10V
C209	" -107	"	100 "
C210	QEW41CA-106	"	10 16V
C211	QCS11HJ-151	C Cap	150p 50V
C212	QEW41AA-336	E Cap	33 10V
C213	QCS11HJ-181	C Cap	180p 50V
C214	" -241	"	240p "
C215	QEW41CA-106	E Cap	10 16V

Symbol No.	Part No.	Part Name	Description
C216	QEW41AA-336	E Cap	33 10V
C217	" -107	"	100 "
C218	" -107	"	100 "
C219	QFM41HK-104	MY Cap	0.1 50V
J 6	A74069-5	Mini Housing	

8-4 DC-DC CONVERTER CIRCUIT BOARD ASS'Y

Symbol No.	Part No.	Part Name	Description
	PU42896A	DC-DC Conv. Ass'y	
	PU42885	Circuit board	
X601	2SA564Q	Transistor	
X602	2SC829C	″	
X603	″	″	
X604	2SC1384R	″	
X605	″	″	
D601	1S2473VE	Diode	
D602	″	″	
D603	″	″	
D604	″	″	
D605	SM-1-12	″	
D606	″	″	
D607	″	″	
D608	″	″	
D609	″	″	
D610	″	″	
D611	″	″	
D612	″	″	
D613	V11L	″	
D614	″	″	
D615	″	″	
D616	″	″	
T601	PU42861	Transformer	
L601	PU42860	Coil	
R601	QRD143K-222	CR	2.2K ¼W,K
R602	″ -471	″	470 ″
R603	″ -471	″	470 ″
R604	″ -821	″	820 ″
R605	″ -821	″	820 ″
R606	″ -472	″	4.7K ″
R607	″ -472	″	4.7K ″
R608	″ -151	″	150 ″
R609	″ -151	″	150 ″
R610	″ -105	″	1M ″
R611	QRC121-106	Comp. R	10M ½W,K
R612	QRD143K-102	CR	1K ¼w,K
R613	QVP2A5B-016	VR	1M
R614	QRD143K-104	CR	100K ¼W,K
R615	QVP4A8B-225	VR	2.2M
R616	QRC121K-275	Comp. R	2.7M ½W,K
R617	″ -125	″	1.2M ″
C601	QCS11HJ-331	C Cap	330p 50V
C602	″ -331	″	330p ″
C603	QFM41HK-472	MY Cap	0.0047 50V
C604	″ -472	″	0.0047 ″
C605	QEW41EA-475	E Cap	4.7 25V
C606	QEW41EA-475	″	4.7 ″
C607	″ -475	″	47 10V
C608	″ -476	″	47 ″
C609			
C610	QFH42JM-153	M Cap	0.015 630V
C611	″ -153	″	0.015 ″
C612	″ -153	″	0.015 ″
C613	″ -153	″	0.015 ″
C614	QFH42GM-104	″	0.1 400V
C615	QFH42GM-104	M Cap	0.1 400V
C616	″ -104	″	0.1 ″
C617	QEW42CA-475	E Cap	4.7 160V
C618	-475	″	4.7 ″
C619	QEW40JA-227	″	220 6.3V
C620	QEW42CA-105	″	1 160V
C621	QEW41HA-476	″	47 50V
C622	QFH42JM-153	M Cap	0.015 630V
C623	″ -153	″	0.015 ″
C624	QFH42GM-104	″	0.1 400V
	A74067-3X	Mini plug	P3,4,5
	A74067-4X	Mini plug	P1,2

8-5 AUTOMATIC SATURATION CONTROL (ASC) AMPLIFIER ASS'Y

Symbol No.	Part No.	Part Name	Description
	PU42973A	ASC Amp. Ass'y	
	PU42972	Circuit Board	
X701	2SC1384Q	Transistor	
D701	0A91	Diode	
D702	"	"	
R701	QRD143K-101	CR	100 ¼W, K
R702	QVP4A0B-102	VR	1K
R703	QRD143K-105	CR	1M ¼W, K
R704	" -102	"	1K "
R705	" -104	"	100K "
R706	QRC121K-226	Comp. R.	22M ½W, K
C701	QFM41HK-104	MY Cap	0.1 50V
C702	QEW41CA-106	E Cap	10 16V
C703	QEE41VM-104	T Cap	0.1 35V

8-6 CAMERA CONTROL UNIT ASS'Y (1)

Symbol No.	Part No.	Part Name	Description
	PU42889C	C.C.U. Amp. P.W.B. Ass'y(1)	
	PU20317-2	Printed Wiring Board	
X 1	2SC829C	Transistor	
X 2	"	"	
X 3	"	"	
X 4	"	"	
X 5	"	"	
X 6	2SA564S	"	
X 7	"	"	
X 8	2SC829C	"	
X 9	"	"	
X10	2SA564S	"	
X11	2SC829C	"	
X12	"	"	
X13	"	"	
X14	"	"	
X15	"	"	
X16	"	"	
X17	2SC828S	"	
X18	2SC829C	"	
X19	"	"	
X20	"	"	
X21	—	—	
X22	2SC829C	Transistor	
X23	"	"	
X24	"	"	
X25	"	"	
X26	"	"	
X27	"	"	
X28	"	"	
X29	"	"	
X30	"	"	
X31	"	"	
X32	"	"	
X33	"	"	
X34	"	"	
X35	2SA564S	"	
X36	"	"	
X37	2SC829C	"	
X38	"	"	
X39	"	"	
X40	"	"	
X41	"	"	
X42	2SA564S	"	
X43	"	"	
X44	2SC829C	"	
X45	"	"	
X46	"	"	
X47	2SA564S	"	
X48	"	"	
IC 1	10HC2F	Integrated Circuit	
IC 2	"	"	
IC 3	"	"	
IC 4	"	"	
IC 5	"	"	
IC 6	10HC2L	"	
IC 7	"	"	
IC 8	"	"	

Symbol No.	Part No.	Part Name	Description
IC 9	10HC2L	Integrated Circuit	
IC10	″	″	
IC11	BA308	″	
IC12	10HC1	″	
IC13	TR8X09	″	
IC14	RB03	″	
IC15	10HC1	″	
D 1	IS2473VE	Diode	
D 2	″	″	
D 3	″	″	
D 4	″	″	
D 5	″	″	
D 6	″	″	
D 7	″	″	
D 8	″	″	
D 9	″	″	
D10	″	″	
D11	″	″	
D12	″	″	
D13	OA91	″	
D14	″	″	
D15	IS2473VE	″	
D16	″	″	
D17	OA91	″	
D18	IS2473VE	″	
D19	OA91	″	
D20	IS2473VE	″	
D21	OA91	″	
D22	″	″	
D23	IS2473VE	″	
D24	OA91	″	
D25	″	″	
D26	IS2473VE	″	
D27	″	″	
D28	″	″	
D29	″	″	
D30	OA91	″	
D31	″	″	
D32	IS2473VE	″	
D33	OA91	″	
D34	IS2473VE	″	
D35	2OA90	″	
D36	″	″	
D37	″	″	
D38	″	″	
D39	″	″	
D40	″	″	
D41	″	″	
D42	″	″	
D43	IS2473VE	″	
D44	″	″	
D45	″	″	
D46	″	″	
Y 1	PU30832	X'tal	
	PU42878	Comb Filter	
T 1	PU41213	Detector Transformer	

Symbol No.	Part No.	Part Name	Description
T 2	PU41213	Detector Transformer	
T 3	″	″	
T 4	″	″	
L 1	A04096-100	Peaking Coil	100μH
L 2	PU40010-102	Choke Coil	1mH
L 3	A04096-100	Peaking Coil	100μH
L 4	″ -10	″	10μH
L 5	″ -18	″	18μH
L 6	″ -100	″	100μH
L 7	″ -10	″	10μH
L 8	″ -270	″	270μH
L 9	″ -10	″	10μH
L10	″ -22	″	22μH
L11	″ -10	″	10μH
R 1	QRD143K-223	CR	22K ¼W,K
R 2	″ -471	″	470 ″
R 3	″ -221	″	220 ″
R 4	″ -392	″	3.9K ″
R 5	″ -473	″	47K ″
R 6	″ -154	″	150K ″
R 7	″ -333	″	33K ″
R 8	QVP4AOB-223	″	22K ″
R 9	QRD143K-563	″	56K ″
R10	″ -153	″	15K ″
R11	″ -332	″	3.3K ″
R12	″ -393	″	39K ″
R13	″ -154	″	150K ″
R14	″ -333	″	33K ″
R15	″ -183	″	18K ″
R16	″ -392	″	3.9K ″
R17	″ -563	″	56K ″
R18	″ -823	″	82K ″
R19	″ -823	″	82K ″
R20	PU42877-683	″	68K ¼W,G
R21	QRD143K-153	″	15K ¼W,K
R22	″ -332	″	3.3K ″
R23	″ -333	″	33K ″
R24	″ -154	″	150K ″
R25	″ -333	″	33K ″
R26	″ -681	″	680 ″
R27	″ -473	″	47K ″
R28	″ -392	″	3.9K ″
R29	″ -473	″	47K ″
R30	QVP4AOB-223	VR	22K
R31	QRD143K-473	CR	47K ¼W,K
R32	″ -472	″	4.7K ″
R33	″ -473	″	47K ″
R34	″ -333	″	33K ″
R35	″ -331	″	330 ″
R36	″ -151	″	150 ″
R37	″ -223	″	22K ″
R38	″ -472	″	4.7K ″
R39	″ -563	″	56K ″
R40	″ -333	″	33K ″
R41	″ -222	″	2.2K ″
R42	″ -393	″	39K ″
R43	″ -563	″	56K ″
R44	″ -563	″	56K ″
R45	″ -222	″	2.2K ″

Symbol No.	Part No.	Part Name	Description
R46	QRD143K-682	CR	6.8K ¼W, K
R47	″ -222	″	2.2K ″
R48	″ -473	″	47K ″
R49	QVP4A0B-472	VR	4.7K
R50	QRD143K-222	CR	2.2K ¼W, K
R51	″ -473	″	47K ″
R52	″ -103	″	10K ″
R53	QVP4A0B-223	VR	22K
R54	QRD143K-563	CR	56K ¼W, K
R55	″ -473	″	47K ″
R56	QVP4A0B-472	VR	4.7K
R57	QRD143K-123	CR	12K ¼W, K
R58	PU42877-683	″	68K ¼W, G
R59	QVP4A0B-223	VR	22K
R60	QRD143K-563	CR	56K ¼W, K
R61	″ -103	″	10K ″
R62	″ -154	″	150K ″
R63	″ -333	″	33K ″
R64	″ -393	″	39K ″
R65	″ -332	″	3.3K ″
R66	″ -123	″	12K ″
R67	PU42877-563	″	56K ¼W, G
R68	QRD143K-473	″	47K ¼W, K
R69	″ -222	″	2.2K ″
R70	″ -473	″	47K ″
R71	″ -223	″	22K ″
R72	PU42877-563	″	56K ¼W, G
R73	QRD143K-223	″	22K ¼W, K
R74	″ -331	″	330 ″
R75	″ -151	″	150 ″
R76	″ -223	″	22K ″
R77	″ -124	″	120K ″
R78	″ -273	″	27K ″
R79	″ -123	″	12K ″
R80	″ -680	″	68 ″
R81	″ -121	″	120 ″
R82	″ -222	″	2.2K ″
R83	″ -682	″	6.8K ″
R84	″ -562	″	5.6K ″
R85	″ -683	″	68K ″
R86	″ -223	″	22K ″
R87	″ -152	″	1.5K ″
R88	″ -471	″	470 ″
R89	″ -681	″	680 ″
R90	″ -680	″	68 ″
R91	″ -121	″	120 ″
R92	″ -152	″	1.5K ″
R93	″ -222	″	2.2K ″
R94	″ -333	″	33K ″
R95	″ -273	″	27K ″
R96	″ -683	″	68K ″
R97	″ -223	″	22K ″
R98	″ -152	″	1.5K ″
R99	″ -471	″	470 ″
R100	″ -272	″	2.7K ″
R101	″ -122	″	1.2K ″
R102	″ -332	″	3.3K ″
R103	QVP4A0B-472	VR	4.7K
R104	QRD143K-562	CR	5.6K ¼W, K
R105	″ -683	″	68K ″
R106	″ -681	″	680 ″
R107	″ -681	″	680 ″
R108	QRD143K-561	CR	560 ¼W,K
R109	″ -683	″	68K ″
R110	″ -223	″	22K ″
R111	″ -102	″	1K ″
R112	″ -102	″	1K ″
R113	″ -152	″	1.5K ″
R114	″ -333	″	33K ″
R115	″ -223	″	22K ″
R116	″ -152	″	1.5K ″
R117	QVP4A0B-102	VR	1K
R118	QRD143K-472	CR	4.7K ¼W, K
R119	″ -103	″	10K ″
R120	″ -152	″	1.5K ″
R121	″ -471	″	470 ″
R122	QVP4A0B-221	VR	220
R123	QRD143K-332	CR	3.3K ¼W, K
R124	″ -101	″	100 ″
R125	″ -121	″	120 ″
R126	″ -272	″	2.7K ″
R127	″ -152	″	1.5K ″
R128	″ -151	″	150 ″
R129	PU42877-471	″	470 ¼W, G
R130	″ -471	″	470 ″
R131	″ -471	″	470 ″
R132	″ -471	″	470 ″
R133	QRD143K-103	″	10K ¼W, K
R134	″ -271	″	270 ″
R135	″ -183	″	18K ″
R136	″ -123	″	12K ″
R137	″ -333	″	33K ″
R138	″ -583	″	68K ″
R139	″ -223	″	22K ″
R140	″ -102	″	1K ″
R141	″ -683	″	68K ″
R142	″ -223	″	22K ″
R143	″ -102	″	1K ″
R144	″ -683	″	68K ″
R145	″ -223	″	22K ″
R146	″ -102	″	1K ″
R147	QVP4A0B-102	VR	1K
R148	QRD143K-152	CR	1.5K ¼W, K
R149	QVP4A0B-103	VR	10K
R150	QRD143K-472	CR	4.7K ¼W, K
R151	″ -103	″	10K ″
R152	″ -152	″	1.5K ″
R153	″ -471	″	470 ″
R154	QVP4A0B-221	VR	220
R155	QRD143K-332	CR	3.3K ¼W, K
R156	″ -101	″	100 ″
R157	″ -121	″	120 ″
R158	″ -272	″	2.7K ″
R159	″ -152	″	1.5K ″
R160	″ -151	″	150 ″
R161	PU42877-471	″	470 ¼W, G
R162	″ -471	″	470 ″
R163	″ -471	″	470 ″
R164	″ -471	″	470 ″
R165	QRD143K-103	″	10K ¼W, K
R166	″ -271	″	270 ″
R167	″ -183	″	18K ″
R168	″ -123	″	12K ″
R169	″ -561	″	560 ″

Symbol No.	Part No.	Part Name	Description
R170	QRD143K-561	CR	560 ¼W,K
R171	″ -561	″	560 ″
R172	″ -153	″	15K ″
R173	″ -123	″	12K ″
R174	″ -561	″	560 ″
R175	″ -272	″	2.7K ″
R176	″ -272	″	2.7K ″
R177	″ -222	″	2.2K ″
R178	″ -181	″	180 ″
R179	″ -221	″	220 ″
R180	″ -820	″	82 ″
R181	″ -123	″	12K ″
R182	″ -104	″	100K ″
R183	″ -122	″	1.2K ″
C 1	QEW41HA-105	E Cap	1μ 50V
C 2	QFF42HJ-271	FM Cap	270p ″
C 3	QCS11HK-330	C Cap	33p ″
C 4	QFF42HJ-121	FM Cap	120p ″
C 5	QCS11HK-820	C Cap	82p ″
C 6	QFF42HJ-181	FM Cap	180p ″
C 7	QEW41AA-476	E Cap	47μ 10V
C 8	″ -105	″	1μ 50V
C 9	QFM41HK-333	MY Cap	0.033 ″
C10	QCS11HK-330	C Cap	33p ″
C11	QFF42HJ-301	FM Cap	300p ″
C12	QCS11HK-820	C Cap	82p ″
C13	QFF42HJ-121	FM Cap	120p ″
C14	QCS11HK-330	C Cap	33p ″
C15	QFF42HJ-181	FM Cap	180p ″
C16	QCS11HK-271	C Cap	270p ″
C17	″ -391	″	390p ″
C18	QFF42HJ-301	FM Cap	300p ″
C19	QEW41HA-105	E Cap	1μ ″
C20	QCS11HK-330	C Cap	33p ″
C21	QFF42HJ-301	FM Cap	300p ″
C22	QCS11HK-271	C Cap	270p ″
C23	QEW41AA-107	E Cap	100μ 10V
C24	QEW41CA-106	″	10μ 16V
C25	QCS11HK-680	C Cap	68p 50V
C26	QFF42HJ-820	FM Cap	82p ″
C27	QCS11HK-330	C Cap	33p ″
C28	QFM41HK-682	MY Cap	0.0068 ″
C29	″ -333	″	0.033 ″
C30	QCS11HK-180	C Cap	18p ″
C31	QFM41HK-222	MY Cap	0.0022 ″
C32	″ -473	″	0.047 ″
C33	″ -273	″	0.027 ″
C34	″ -682	″	0.0068 ″
C35	QEW41HA-105	E Cap	1μ ″
C36	QFM41HK-102	MY Cap	0.001 ″
C37	″ -822	″	0.0082 ″
C38	″ -473	″	0.047 ″
C39	″ -102	″	0.001 ″
C40	″ -154	″	0.15 ″
C41	QEW41CA-106	E Cap	10μ 16V
C42	QEW41AA-227	″	220μ 10V
C43	QEW41CA-106	″	10μ 16V
C44	QCS11HK-180	C Cap	18p 50V
C45	QEW41AA-336	E Cap	33μ 10V
C46	″ -336	″	33μ ″
C47	QEW41HA-105	″	1μ 50V

Symbol No.	Part No.	Part Name	Description
C48	QEW41AA-107	E Cap	100μ 10V
C49	QEW41CA-106	″	10μ 16V
C50	QEW41AA-336	″	33μ 10V
C51	″ -336	″	33μ ″
C52	″ -107	″	100μ ″
C53	QFM41HK-103	MY Cap	0.01 50V
C54	″ -103	″	0.01 ″
C55	QEW41HA-105	E Cap	1μ ″
C56	QFM41HK-103	MY Cap	0.01 ″
C57	″ -103	″	0.01 ″
C58	QCS11HK-101	C Cap	100p ″
C59	″ -180	″	18p ″
C60	QEW41HA-105	E Cap	1μ ″
C61	QFM41HK-103	MY Cap	0.01 ″
C62	QEW41AA-336	E Cap	33μ 10V
C63	PU41618-7	T Cap	0.47 35V
C64	QEW41HA-105	E Cap	1μ 50V
C65	QEW41AA-107	″	100μ 10V
C66	QFF42HJ-331	FM Cap	330p 50V
C67	QFM41HK-103	MY Cap	0.01 ″
C68	″ -104	″	0.1 ″
C69	PU41618	T Cap	1 25V
C70	QEW41AA-227	E Cap	220u 10V
C71	″ -107	″	100u ″
C72	″ -336	″	33μ ″
C73	″ -336	″	33μ ″
C74	″ -336	″	33μ ″
C75	″ -336	″	33μ ″
C76	QEW41HA-105	″	1μ 50V
C77	PU41618-7	T Cap	0.47 35V
C78	QEW41HA-105	E Cap	1μ 50V
C79	QEW41AA-107	″	100u 10V
C80	QFF42HJ-331	FM Cap	330p 50V
C81	QCF11EZ-203	C Cap	0.02 25V
C82	QFM41HK-104	MY Cap	0.1 50V
C83	QFF42HJ-820	FM Cap	82p ″
C84	QFM41HK-103	MY Cap	0.01 ″
C85	″ -104	″	0.1 ″
C86	″ -103	″	0.01 ″
C87	QFF42HJ-100	FM Cap	10p ″
C88			
C89	QFF42HJ-150	FM Cap	15p 50V
C90	QFM41HK-103	MY Cap	0.01 ″
C91	QEW41HA-105	E Cap	1μ ″
C92	″ -105	″	1μ ″
C93	QEW41CA-106	″	10μ 16V
C94	QFM41HK-393	MY Cap	0.039 50V
C95	″ -103	″	0.01 ″
C96	QCS11HK-101	C Cap	100p ″
C97	″ -101	″	100p ″
C98	″ -151	″	150p ″
C99	QEW41AA-227	E Cap	220μ 10V
C100	QCF11EZ-203	C Cap	0.02 25V
C101	″ -203	″	0.02 ″
C102	QFM41HK-104	MY Cap	0.1 50V
C103	QCS11HK-680	C Cap	68p ″
C104	″ -680	″	68p ″
C105	″ -680	″	68p ″
P10	A74067-3X	Mini Plug	
P11	″ -5X	″	
P12	″ -3X	″	

Symbol No.	Part No.	Part Name	Description
P13	A74067-5X	Mini Plug	
P14	" -4X	"	
P15	" -5X	"	
J 3	A74069-3	Mini Housing	
J 4	" -5	"	
J 5	" -4	"	
	PU42922A	Sticker	

8-7 CAMERA CONTROL UNIT ASS'Y (2)

Symbol No.	Part No.	Part Name	Description
	PU42890A	CCU-2 P.W.B. Ass'y (2)	
	PU20318	Printed Wiring Board	
X 1	2SC829C	Transistor	
X 2	"	"	
X 3	"	"	
X 4	"	"	
X 5	2SA564S	"	
X 6	"	"	
X 7	2SC829C	"	
X 8	2SA564S	"	
X 9	"	"	
X10	2SC829C	"	
X11	2SA564S	"	
X12	"	"	
X13	"	"	
X14	2SC829C	"	
X15	2SC828S	"	
X16	2SA564S	"	
X17	"	"	
X18	"	"	
X19	2SC829C	"	
X20	"	"	
X21	"	"	
X22	"	"	
X23	2SA564S	"	
X24	2SK30-0	Field Effect Transistor	
X25	—	—	
X26	2SA564S	Transistor	
X27	"	"	
X28	2SC829C	"	
X29	2SA564S	"	
X30	"	"	
X31	2SC829C	"	
X32	"	"	
X33	"	"	
X34	—	—	
X35	—	—	
X36	—	—	
X37	—	—	
X38	2SA564S	Transistor	
X39	2SC829C	"	
X40	"	"	
X41	"	"	
X42	"	"	
X43	2SA564S	"	
X44	2SC829C	"	
X45	"	"	
X46	"	"	
X47	—	—	
X48	—	—	
X49	—	—	
X50	—	—	
X51	2SA564S	Transistor	
X52	2SC829C	"	
X53	"	"	
X54	"	"	
X55	"	"	
X56	2SA564S	"	

Symbol No.	Part No.	Part Name	Description
X57	2SC829C	Transistor	
X58	2SA564S	"	
X59	2SC829C	"	
X60	"	"	
X61	"	"	
IC 1	10HC3	Integrated Circuit	
IC 2	10HC1	"	
IC 3	6HC1	"	
IC 4	10HC3	"	
IC 5	6HC1	"	
IC 6	10HC3	"	
IC 7	6HC1	"	
IC 8	10HC3	"	
IC 9	6HC1	"	
IC10	L141	"	
IC11	BA308	"	
IC12	10HC1	"	
IC13	BA308	"	
IC14	"	"	
IC15	10HC1	"	
D 1	IS2473VE	Diode	
D 2	"	"	
D 3	"	"	
D 4	"	"	
D 5	"	"	
D 6	"	"	
D 7	"	"	
D 8	"	"	
D 9	"	"	
D10	"	"	
D11	"	"	
D12	"	"	
LC1	PU42873	LC Block	
DL1	PU42874	Delay Line	
L 1	A04096-100	Peaking Coil	100μ
L 2	" -100	"	"
L 3	" -100	"	"
L 4	" -100	"	"
L 5	" -100	"	"
L 6	PU42875-330	"	33μH
L 7	" -130	"	13μH
L 8	" -100	"	10μH
L 9	" -301	"	300μH
L10	" -301	"	"
L11	" -301	"	"
L12	" -301	"	"
L13	" -220	"	22μH
L14	" -201	"	200μH
L15	" -110	"	11μH
L16	" -201	"	200μH
L17	" -220	"	22μH
L18	A04096-560	"	560μH
L19	" -100	"	100μH
L20	" -150	"	150μH
L21	PU42875-910	"	91μH
L22	" -301	"	300μH
L23	" -101	"	100μH

Symbol No.	Part No.	Part Name	Description
L24	PU42875-201	Peaking Coil	200μH
L25	" -101	"	100μH
L26	" -750	"	75μH
L27	A04096-1000	"	1mH
L28	" -100	"	100μH
L29	" -150	"	150μH
L30	" -150	"	"
L31	PU42875-910	"	91μH
L32	" -301	"	300μH
L33	" -301	"	300μH
R 1	QRD143K-820	CR	82 ¼W,K
R 2	" -471	"	470 "
R 3	" -561	"	560 "
R 4	" -683	"	68K "
R 5	" -223	"	22K "
R 6	" -152	"	1.5K "
R 7	" -471	"	470 "
R 8	" -683	"	68K "
R 9	" -223	"	22K "
R10	" -103	"	10K "
R11	" -471	"	470 "
R12	QVP4A0B-221	VR	220
R13	QRD143K-223	CR	22K ¼W,K
R14	" -223	"	22K "
R15	QVP4A0B-472	VR	4.7K
R16	QRD143K-103	CR	10K ¼W,K
R17	" -102	"	1K "
R18	" -272	"	2.7K "
R19	" -102	"	1K "
R20	" -334	"	330K "
R21	" -392	"	3.9K "
R22	" -563	"	56K "
R23	" -473	"	47K "
R24	" -152	"	1.5K "
R25	" -182	"	1.8K "
R26	" -182	"	1.8K "
R27	" -682	"	6.8K "
R28	" -331	"	330 "
R29	" -272	"	2.7K "
R30	" -101	"	100 "
R31	QVP4A0B-472	VR	4.7K
R32	" -472	"	4.7K
R33	" -472	"	4.7K
R34	" -472	"	4.7K
R35	QRD143K-122	CR	1.2K ¼W,K
R36	" -822	"	8.2K "
R37	" -101	"	100 "
R38	" -472	"	4.7K "
R39	" -102	"	1K "
R40	" -222	"	2.2K "
R41	QVP4A0B-222	VR	2.2K
R42	QRD143K-682	CR	6.8K ¼W,K
R43	" -561	"	560 "
R44	" -153	"	15K "
R45	" -683	"	68K "
R46	" -681	"	680 "
R47	" -222	"	2.2K "
R48	" -272	"	2.7K "
R49	" -103	"	10K "
R50	QVP4A0B-222	VR	2.2K
R51	QRD143K-152	CR	1.5K ¼W,K

Symbol No.	Part No.	Part Name	Description
R52	QRD143K-331	CR	330 ¼W,K
R53	" -151	"	150 "
R54	" -334	"	330K "
R55	" -562	"	5.6K "
R56	" -123	"	12K "
R57	" -562	"	5.6K "
R58	" -223	"	22K "
R59	" -152	"	1.5K "
R60	" -681	"	680 "
R61	" -153	"	15K "
R62	" -123	"	12K "
R63	" -122	"	1.2K "
R64	" -473	"	47K "
R65	" -392	"	3.9K "
R66	" -682	"	6.8K "
R67	" -123	"	12K "
R68	" -820	"	82 "
R69	" -103	"	10K "
R70	" -822	"	8.2K "
R71	" -472	"	4.7K "
R72	" -222	"	2.2K "
R73	" -472	"	4.7K "
R74	" -152	"	1.5K "
R75	" -103	"	10K "
R76	" -105	"	1M "
R77	—	—	
R78	—	—	
R79	—	—	
R80	—	—	
R81	QRD143K-561	CR	560 ¼W,K
R82	" -221	"	220 "
R83	" -152	"	1.5K "
R84	" -123	"	12K "
R85	PU42871-561	O.M.R.	560 ¼W,J
R86	QRD143K-472	CR	4.7K ¼W,K
R87	" -562	"	5.6K "
R88	" -102	"	1K "
R89	" -182	"	1.8K "
R90	" -182	"	1.8K "
R91	" -563	"	56K "
R92	QVP4A0B-472	VR	4.7K
R93	QRD143K-123	CR	12K ¼W,K
R94	" -152	"	1.5K "
R95	" -683	"	68K "
R96	" -562	"	5.6K "
R97	" -182	"	1.8K "
R98	" -222	"	2.2K "
R99	" -221	"	220 "
R100	" -102	"	1K "
R101	" -471	"	470 "
R102	" -152	"	1.5K "
R103	" -152	"	1.5K "
R104	" -152	"	1.5K "
R105	" -471	"	470 "
R106	" -223	"	22K "
R107	" -223	"	22K "
R108	PU42877-182	"	1.8K ¼W, G
R109	" -222	"	2.2K "
R110	QRD143K-102	"	1K ¼W,K
R111	" -2R2	"	2.2 "
R112	" -472	"	4.7K "
R113	" -392	"	3.9K "

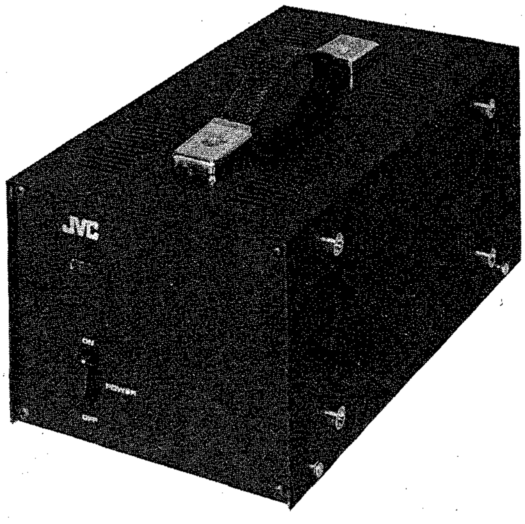
Symbol No.	Part No.	Part Name	Description
R114	QRD143K-222	CR	2.2K ¼W,K
R115	E03511-103	VR	10K
R116	QRD143K-333	CR	33K ¼W, K
R117	" -271	"	270 "
R118	" -330	"	33 "
R119	" -271	"	270 "
R120	" -331	"	330 "
R121	" 2R2	"	2.2 "
R122	" -221	"	220 "
R123	" -102	"	1K "
R124	" -562	"	5.6K "
R125	" -562	"	5.6K "
R126	" -561	"	560 "
R127	" -561	"	560 "
R128	ERT-D2FHL 1035	Thermistor	
R129	QRD143K-683	CR	68K ¼W,K
R130	" -562	"	5.6K "
R131	" -471	"	470 "
R132	E03511-472	VR	4.7K
R133	QRD143K-222	CR	2.2K ¼W,K
R134	" -102	"	1K "
R135	" -392	"	3.9K "
R136	" -222	"	2.2K "
R137	" -562	"	5.6K "
R138	" -153	"	15K "
R139	" -821	"	820 "
R140	" -822	"	8.2K "
R141	" -221	"	220 "
R142	" -471	"	470 "
R143	" -682	"	6.8K "
R144	" -822	"	8.2K "
R145	" -272	"	2.7K "
R146	" -471	"	470 "
R147	" -222	"	2.2K "
R148	E03511-222	VR	2.2K
R149	QRD143K-392	CR	3.9K ¼W,K
R150	" -272	"	2.7K "
R151	" -471	"	470 "
R152	" -152	"	1.5K "
R153	" -471	"	470 "
R154	" -223	"	22K "
R155	" -223	"	22K "
R156	QVP4A0B-222	VR	2.2K
R157	QRD143K-822	CR	8.2K ¼W,K
R158	" -182	"	1.8K "
R159	" -222	"	2.2K "
R160	" -221	"	220 "
R161	" -561	"	560 "
R162	" -561	"	560 "
R163	ERT-D2FHL 103S	Thermistor	
R164	QRD143K-683	CR	68K ¼W,K
R165	" -562	"	5.6K "
R166	" -102	"	1K "
R167	" -471	"	470 "
R168	QVP4A0B-472	VR	4.7K
R169	" -222	"	2.2K
R170	QRD143K-104	CR	100K ¼W,K
R171	" -153	"	15K "
R172	" -331	"	330 "
R173	" -392	"	3.9K "

Symbol No.	Part No.	Part Name	Description
R174	QRD143K-682	CR	6.8K ¼W,K
R175	″ -471	″	470 ″
R176	″ -272	″	2.7K ″
R177	″ -153	″	15K ″
R178	″ -821	″	820 ″
R179	″ -822	″	8.2K ″
R180	″ -221	″	220 ″
R181	″ -471	″	470 ″
R182	″ -682	″	6.8K ″
R183	″ -822	″	8.2K ″
R184	″ -471	″	470 ″
R185	″ -272	″	2.7K ″
R186	″ -182	″	1.8K ″
R187	E03511-472	VR	4.7K
R188	QRD143K-392	CR	3.9K ¼W,K
R189	E03511-472	VR	4.7K
R190	QRD143K-272	CR	2.7K ¼W,K
R191	″ -471	″	470 ″
R192	″ -152	″	1.5K ″
R193	″ -152	″	1.5K ″
R194	″ -471	″	470 ″
R195	″ -223	″	22K ″
R196	″ -223	″	22K ″
R197	QVP4A0B-472	VR	4.7K
R198	PU42877-182	CR	1.8K ¼W,G
R199	″ -222	″	2.2K ″
R200	QRD143K-683	″	68K ¼W,K
R201	″ -153	″	15K ″
R202	″ -122	″	1.2K ″
R203	″ -152	″	1.5K ″
R204	″ -471	″	470 ″
R205	″ -470	″	47 ″
R206	″ -471	″	470 ″
R207	″ -821	″	820 ″
R208	″ -2R2	″	2.2 ″
R209	″ -333	″	33K ″
R210	″ -221	″	220 ″
C 1	QEW41AA-107	E Cap	100 10V
C 2	″ -476	″	47 ″
C 3	″ -107	″	100 ″
C 4	″ -107	″	100 ″
C 5	″ -107	″	100 ″
C 6	QCT05UJ-101	C Cap	100p 50V
C 7	″ -101	″	100p ″
C 8	″ -361	″	360p ″
C 9	QEW41AA-336	E Cap	33 10V
C10	QCS11HK-151	C Cap	150p 50V
C11	QEW41AA-336	E Cap	33 10V
C12	QEW41CA-106	″	10 16V
C13	QFM41HK-103	MY Cap	0.01 50V
C14	QEW41CA-106	E Cap	10 16V
C15	PU41618-7	T Cap	0.47 35V
C16	QEW41AA-336	E Cap	33 10V
C17	PU41618-5	T Cap	0.1 35V
C18	QEW41AA-336	E Cap	33 10V
C19	″ -336	″	33 ″
C20	″ -336	″	33 ″
C21	QCT05UJ-181	C Cap	180p 50V
C22	QEW41AA-336	E Cap	33 10V
C23	″ -336	″	33 ″
C24	″ -336	″	33 ″

Symbol No.	Part No.	Part Name	Description
C25	QEW41AA-336	E Cap	33 10V
C26	″ -476	″	47 ″
C27	QEW41CA-106	″	10 16V
C28	PU41618-7	T Cap	0.47 35V
C29	″ -7	″	0.47 ″
C30	″ -7	″	0.47 ″
C31	QEW41AA-336	E Cap	33 10V
C32	PU41618-5	T Cap	0.1 35V
C33	QEW41AA-336	E Cap	33 10V
C34	QEW41CA-106	″	10 16V
C35	″ -106	″	10 ″
C36	QCS11HK-331	C Cap	330p 50V
C37	QFM41HK-682	MY Cap	0.0068 ″
C38	QCS11HK-270	C Cap	27p ″
C39	″ -151	″	150p ″
C40	QFM41HK-104	MY Cap	0.1 ″
C41	″ -102	″	0.001 ″
C42	QEW41AA-336	E Cap	33 10V
C43	QCS11HK-220	C Cap	22p 50V
C44	″ -100	″	10p ″
C45	PU41618-4	T Cap	22 16V
C46	——	——	
C47	——	——	
C48	QEW41AA-107	E Cap	100 10V
C49	QCS11HK-331	C Cap	330p 50V
C50	QEW41CA-106	E Cap	10 16V
C51	QCS11HK-331	C Cap	330p 50V
C52	QEW41AA-336	E Cap	33 10V
C53	″ -476	″	47 ″
C54	QCT05UJ-681	C Cap	680p 50V
C55	″ -681	″	680p ″
C56	″ -681	″	680p ″
C57	″ -681	″	680p ″
C58	″ -681	″	680p ″
C59	″ -681	″	680p ″
C60	″ -681	″	680p ″
C61	″ -681	″	680p ″
C62	QEW41AA-476	E Cap	47 10V
C63	″ -476	″	47 ″
C64	″ -476	″	47 ″
C65	QEW41HA-105	″	1 50V
C66	QEW41AA-476	″	47 10V
C67	QEW41HA-105	″	1 50V
C68	QCT05UJ-180	C Cap	18p ″
C69	″ -301	″	300p ″
C70	″ -330	″	33p ″
C71	″ -331	″	330p ″
C72	″ -301	″	300p ″
C73	″ -330	″	33p ″
C74	″ -180	″	18p ″
C75	″ -301	″	300p ″
C76	QEW41HA-105	E Cap	1 ″
C77			
C78	PU41618-5	T Cap	0.1 35V
C79	QEW41HA-105	E Cap	1 50V
C80	QFM41HK-102	MY Cap	0.001 ″
C81	QEW41HA-105	E Cap	1 ″
C82	″ -105	″	1 ″
C83	QEW41AA-476	″	47 10V
C84	″ -476	″	47 ″
C85	QEW41HA-105	″	1 50V
C86	QEW41AA-476	″	47 10V

Symbol No.	Part No.	Part Name	Description
C87	QCT05UJ-620	C Cap	62p 50V
C88	″ -681	″	680p ″
C89	″ -681	″	680p ″
C90	QEW41AA-476	E Cap	47 10V
C91	″ -476	″	47 ″
C92	QEW41HA-105	″	1 50V
C93	QCT05UJ-180	C Cap	18p ″
C94	″ -301	″	300p ″
C95	″ -100	″	10p ″
C96	″ -151	″	150p ″
C97	″ -820	″	82p ″
C98	″ -431	″	430p ″
C99	″ -121	″	120p ″
C100	QEW41HA-105	E Cap	1 ″
C101			
C102	QEW41HA-105	E Cap	1 50V
C103	PU41618-5	T Cap	0.1 35V
C104	QEW41HA-105	E Cap	1 50V
C105	QCS11HK-101	C Cap	100p ″
C106	QEW41HA-105	E Cap	1 ″
C107	QEW41AA-476	″	47 10V
C108	QEW41HA-105	″	1 50V
C109	QEW41AA-476	″	47 10V
C110	″ -476	″	47 ″
C111	″ -476	″	47 ″
C112	″ -476	″	47 ″
C113	QCT05UJ-620	C Cap	62p 50V
C114	″ -681	″	680p ″
C115	″ -681	″	680p ″
C116	″ -681	″	680p ″
C117	″ -681	″	680p ″
C118	QEW41AA-476	E Cap	47 10V
C119	″ -476	″	47 ″
C120	″ -476	″	47 ″
C121	″ -336	″	33 ″
C122	QEW41HA-105	″	1 50V
C123	QCF11EZ-103	C Cap	0.01μ 25V
P 1	A74067-5X	Mini Plug	
P 2	″ -4X	″	
P 3	″ -3X	″	
P 4	″ -5X	″	
P 5	″ -4X	″	
P 6	″ -4X	″	
P 8	A74017	Tab	
J12	A74069-3	Mini Housing	
J15	A74069-5	″	
	PU40734	Test Point	
	PU41571	Pin	

JVC Service Manual



MODEL GA-20U

JVC INDUSTRIES, INC.
Subsidiary of
Victor Company of Japan, Limited.

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SPECIFICATIONS

Rated output voltage	: 13V DC
Rated output current	: 1.2A
Video signal input	: 1 Vp-p (75Ω)
Video signal output	: 1 Vp-p (75Ω)
Audio signal input	: MIC : −72db (600Ω) Line : −20db (high impedance)
Audio signal output	: −20db (high impedance) (Note: The output drops by about 2db when terminated by 600Ω)
RF signal output	: With the optional KR-200U, 66 ± 3dBμ, which consists of a converter unit either for channels 3/4 (switchable), or channels 5/6 (switchable), models KR-234U or KR-256U, respectively, and also a switch box with antenna cable, SW-200U.
Horizontal sync signal output	: 15.734kHz, more than 4 Vp-p (negative)
Vertical sync signal output	: 59.94 Hz, more than 4 Vp-p (negative)
Sync	: 2 to 1 interlace
VCR remote control terminal	: In REC LOCK condition the VCR starts and stops from the video camera's start/stop switch
Semiconductors	: ICs 5 Transistors 15 Diodes 12
Power source	: 120V AC, 60Hz
Power consumption	: 35W (When used with GC-4800U)
Operating temperature	: 32°F to 104°F (0°−40°C)
Dimensions	: 5-3/4"(H) x 5-15/16"(W) x 10-7/8" (D) (145 mm x 150 mm x 275 mm)
Weight	: 10-1/2 lbs
Accessories included	: CCU holder PU30863A & B 1.5A fuse QMF61U1-1R5 Power cord QMP9003-011 Instruction book PU30425-49

Design and specifications subject to change without notice.

FEATURES

1. Permits the use of the GC-4800U Color Video Camera as a studio camera.
2. With the KR-200U Color RF Converter installed, a regular TV can serve as a monitor for video and audio.
3. The high stability sync signal generator, with a quartz crystal oscillator, assures stable operation and accurate 2 : 1 interlace.
4. The addition of a MIC terminal allows a microphone other than that in the GC-4800U to be used. When the external microphone is plugged in, the camera's built-in mike is disconnected.
5. When JVC U-VCR recorders are used, they can be controlled from the camera. The GA-20U REMOTE terminal must be connected to VCR REMOTE terminal with the optional cable. (VC-222)
6. The GC-4800U Camera Control Unit can be clamped to the side of the GA-20U using the special holder supplied.

CONNECTIONS AND CONTROLS

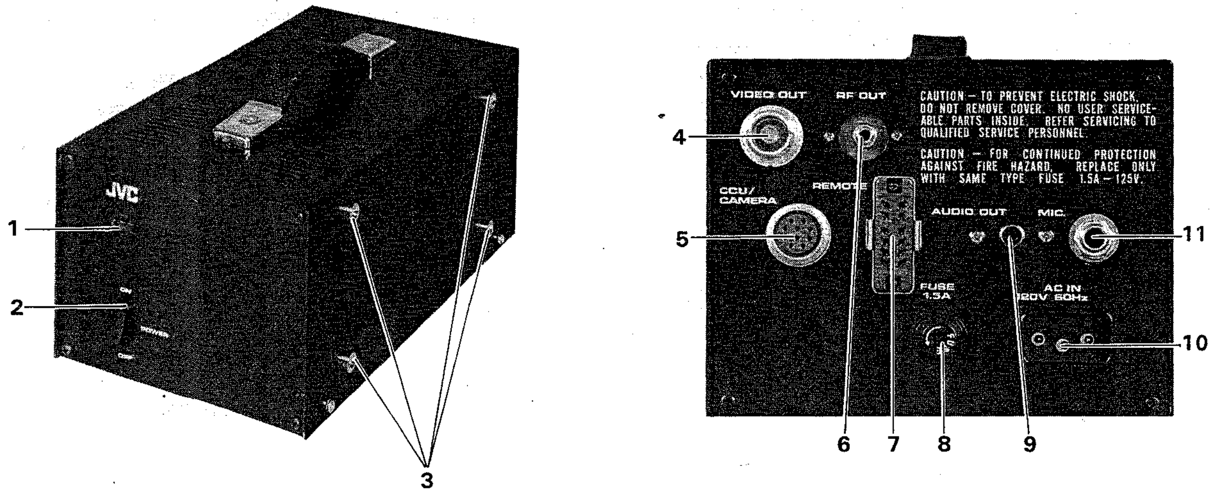

1
2
3
JVC
ON
POWER
OFF
4
5
6
7
8
9
10
11
VIDEO OUT
RF OUT
CAUTION — TO PREVENT ELECTRIC SHOCK, DO NOT REMOVE COVER. NO USER SERVICEABLE PARTS INSIDE. REFER SERVICING TO QUALIFIED SERVICE PERSONNEL.
CAUTION — FOR CONTINUED PROTECTION AGAINST FIRE HAZARD, REPLACE ONLY WITH SAME TYPE FUSE 1.5A — 125V.
CCU/ CAMERA
REMOTE
AUDIO OUT
MIC.
FUSE 1.5A
AC IN 120V 60Hz

Fig. 1

1. **Pilot lamp**
   This lights when the POWER switch is turned ON.
2. **POWER switch**
3. **CCU Holder mounting holes**
   To attach the Camera Control Unit Holder.
4. **Video output terminal**
   The video signal from the GC-4800U is available at this terminal as an NTSC-type signal. The output signal is 1 Vp-p with an output impedance of 75Ω.
5. **CCU terminal**
   The 10-pin cable from the GC-4800U CCU is plugged into this terminal.
   The 10-pin cable from the GS-4500 can also be connected and the GA-20U used as a black & white camera adapter.
6. **RF output terminal**
   When the KR-200U Color RF Converter is installed, the RF signal is available. This permits the use of a regular color TV for monitoring.
7. **VCR REMOTE control terminal**
   This is connected to the REMOTE terminal of the JVC U-VCRs CR-6000U/6100U with the optional VC-222 Cable 6.5 ft (2 m).
8. **Fuse holder**
   The GA-20U circuitry is protected by a 1.5A fuse in this holder.
9. **AUDIO OUT terminal**
   Connect to the VTR/VCR audio input terminal. The output level is —20db.
10. **AC power socket**
11. **MIC terminal**
    For the connection of an external microphone. Plugging in an external mike disconnects the GC-4800U mike.

OPERATION

1. **AUDIO/VIDEO MONITORING WITH REGULAR COLOR TV**

1) To do this the KR-200U Color RF Converter must be installed. This should be done by a qualified service technician.
2) Connect the GC-4800U Camera Control Unit to the CCU terminal on the GA-20U rear panel. Use the CCU Holder to clamp the CCU to the side of the GA-20U. Pass the CCU cable through the hooks in the base of the CCU.
3) Connect the cable from the GC-4800U Camera Head to the CAMERA terminal on the CCU front panel.
   NOTE: If a longer cable is desired, the optional 32 ft. (10 m) VC-221 Camera Cable is available.

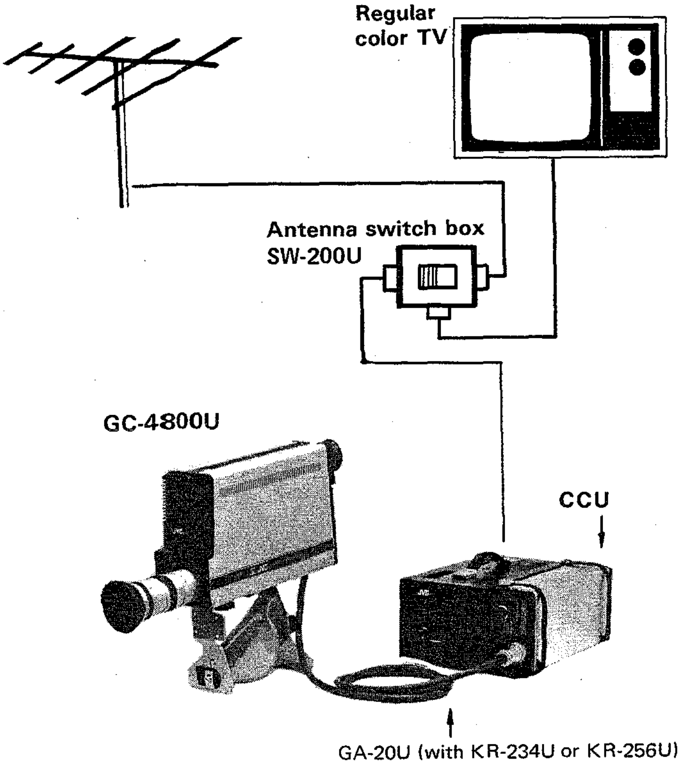


Fig. 2

4) Connect the GA-20U RF output terminal to the antenna switch box and the TV terminal of the switch box to the UHF antenna terminal of a color TV.

CAUTION: Do NOT connect the RF output of GA-20U to an external antenna directly. Failure to use an antenna switch box may result in operation that violates the Federal laws regulating the use and operation of RF devices.

2. RECORDING WITH VTR/VCR OR OTHER STUDIO EQUIPMENT

1) Connect the CCU as described above.
2) With the optional VC-102U Video Cable, connect the GA-20U VIDEO OUT terminal to the VTR/VCR video input terminal.
3) Connect the GA-20U AUDIO OUT jack to the VTR/VCR audio input jack with the optional CN-309 cable.
4) If the GC-4800U is used with studio equipment the following information will be useful when making connections:

   Video output : 1 Vp-p, 75Ω UHF terminal
   Audio output : -20db open circuit, RCA-pin

5) If an external microphone is used it should be rated at -72db, 600Ω.

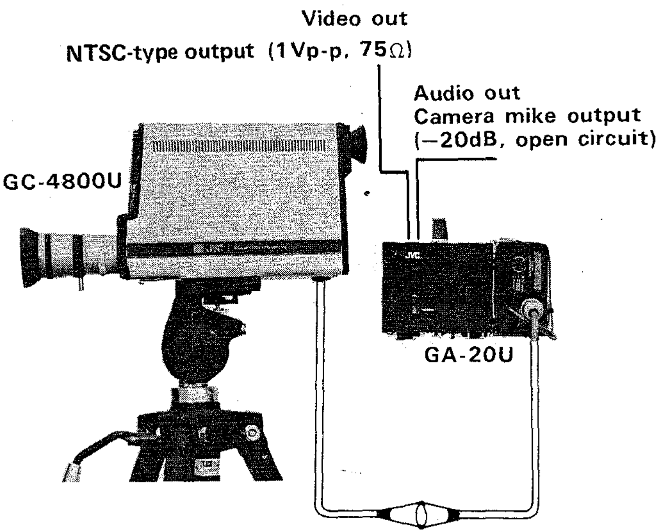


Fig. 3

3. RECORDING WITH A U-VCR VIDEO CASSETTE RECORDER: REMOTE CONTROL

1) Connect the camera, CCU and GA-20U as previously described.
2) Using the optional VC-222 6.5 ft. cable connect the U-VCR REMOTE terminal to the GA-20U REMOTE terminal
3) Apply power to the GA-20U and VCR.
4) Lock the VCR REC LOCK switch.

   CAUTION: When recording with U-VCR, these two operations must be performed in the correct order. If the REC LOCK switch is ON when power is applied, recording will start.

5) To start recording, press the GC-4800U START/STOP switch. The VCR will load the tape and begin recording. Approximately 10 seconds is required for loading and lockup.
6) To stop recording press the GC-4800U START/STOP switch again. The VCR will unload the tape and rewind a small portion of it.

   These operations take about 10 seconds.

   NOTE: Because of this sequence of operations the tape is positioned so that an overlap of 20 to 30 seconds occurs when recording is next started.

7) When a sequence of scenes is being recorded using the remote control you should consider the following:

   When a scene is complete, continue recording for an additional 20 – 30 seconds before going to STOP.

4. USING THE BLACK-AND-WHITE VIDEO CAMERA MODELS GS-4500/GS-4600U

Connect the GS-4500 10-pin connector to the GA-20U CCU connection terminal. The GA-20U will then work as a black & white camera adapter.

NOTE: For connections between the GA-20U and other audio/video equipment see the preceding sections.

HOW TO REMOVE COVER

1. Remove the four screws① and CCU holders② and ③.
2. Remove the four screws④.
3. Remove the cover⑥ from chassis⑤ by lifting.

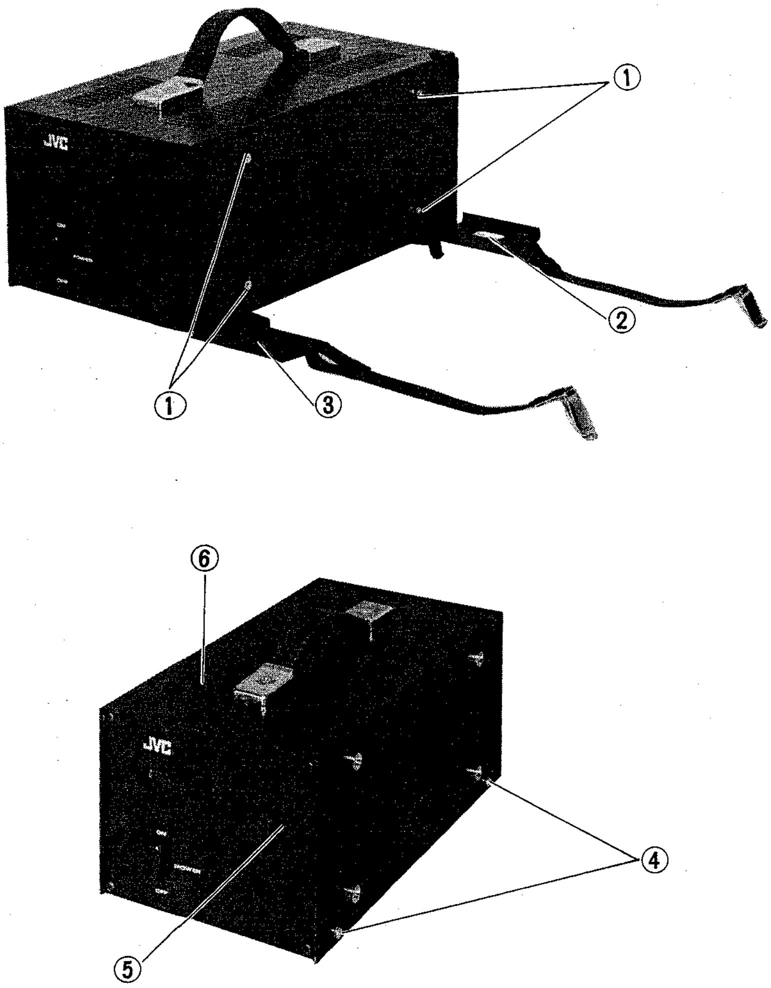


Fig. 4

ADJUSTMENT

Voltage Adjustment

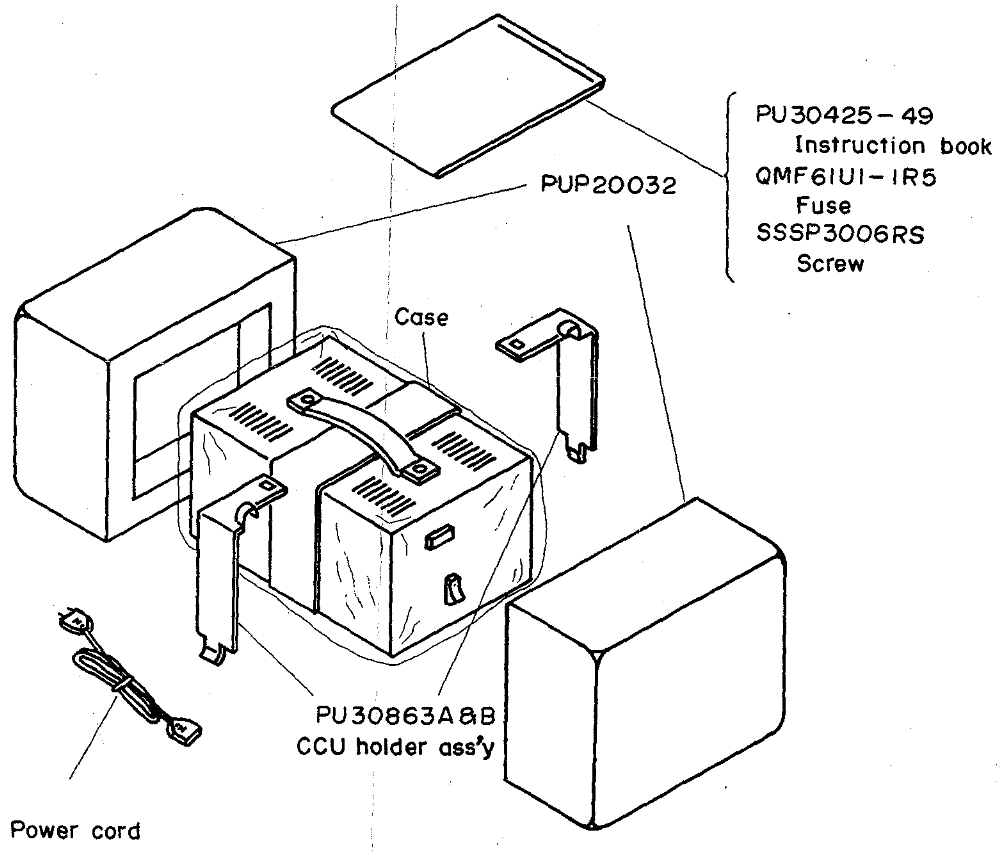
Connect a DC voltmeter to terminal ⑪ on the circuit board and adjust variable resistor R35 until the voltage is +13V.

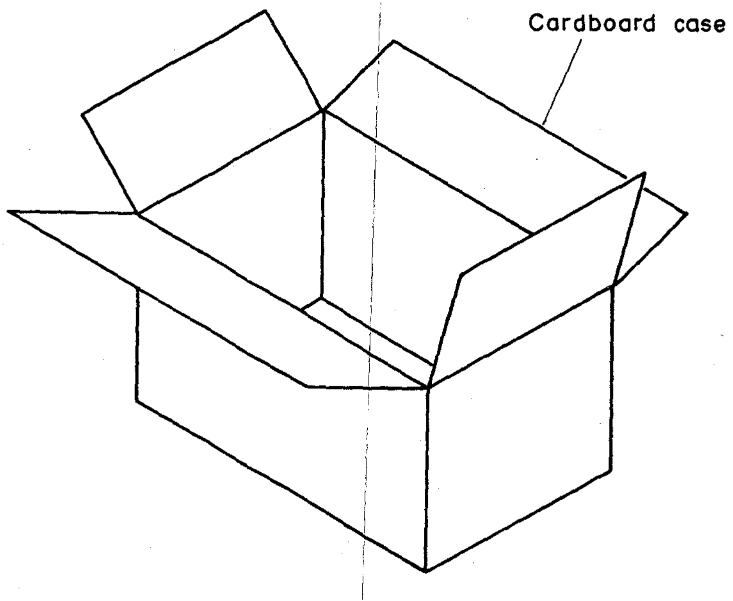
This is the only adjustment required on the GA-20U.

TROUBLESHOOTING GUIDE

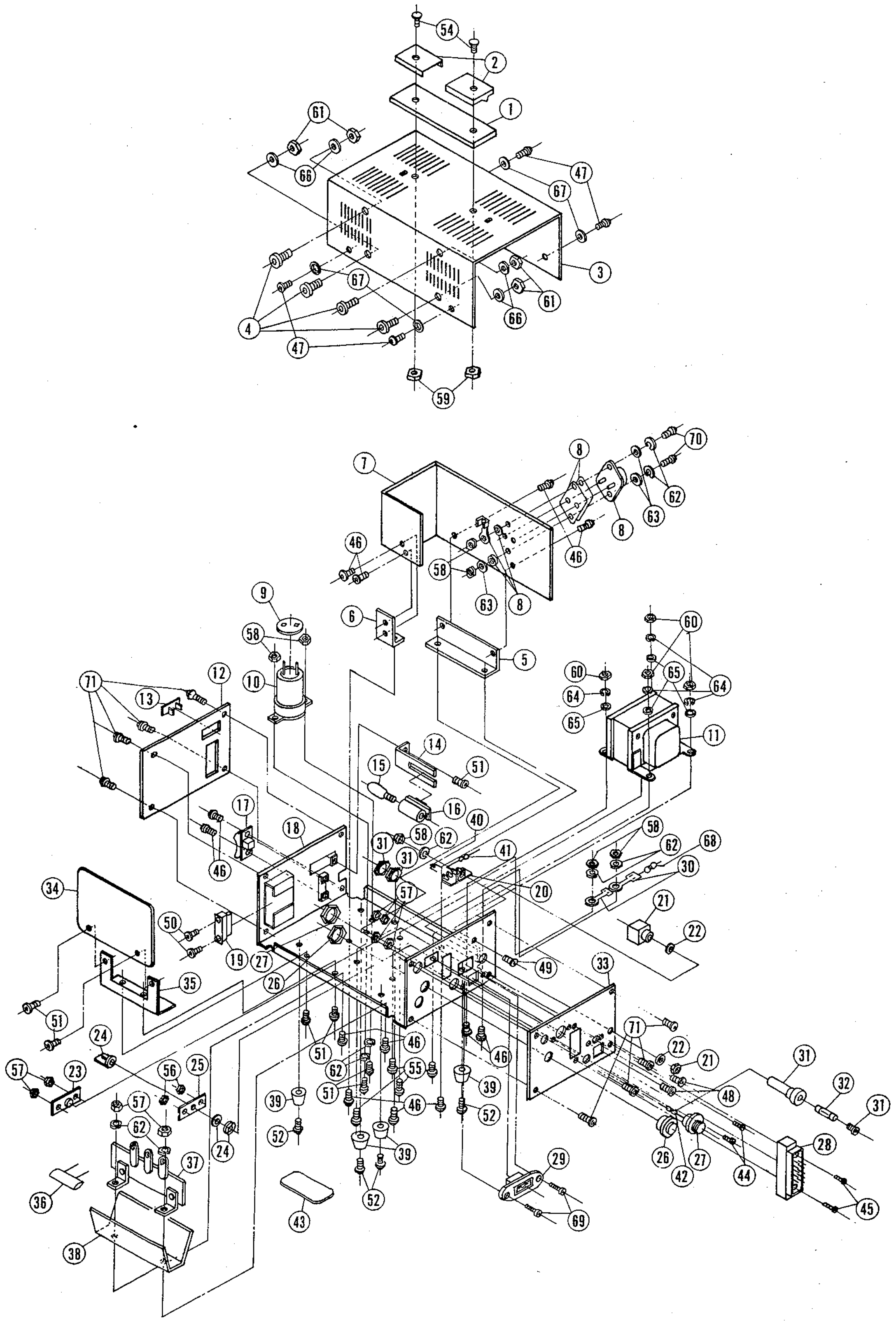
1. No 13V DC at the CCU/CAMERA terminal.
   - Pilot lamp does not light.
     - Fuse is open.
     - Power switch trouble.
   - Pilot lamp lights.
     - Fuse is open.
     - X101 is defective.
     - X8 – X10 failure. —— Check voltage.
2. No video output.
   - No video signal at pin ⑫ on circuit board
     - The camera or camera cable is faulty.
     - Open circuit in input signal wiring.
   - X1, X2, X12 or X13 is faulty.
   - Open circuit in output signal wiring.
3. No audio output
   - No audio signal at pin ⑱ on circuit board.
     - The camera or camera cable is faulty.
     - Open circuit in input signal wiring.
   - IC 1 or X3 is faulty.
   - Open circuit in output signal wiring.
4. No RF output
   - +9V DC is absent at RF connector pin 5. — X14 or X15 is defective.
   - Open circuit between RF connector and circuit board
   - RF converter is faulty.
5. No sync signal at the CCU/CAMERA terminal.
   - Crystal oscillator is faulty.
   - One or more of the integrated circuits IC 3 – IC15 is faulty.
   - No 5V DC —— X11 is faulty.
   - Open circuit in output signal wiring.
6. Remote control does not function.
   - Open circuit in remote control cable.
   - +26V DC is absent at pin ㉕ on circuit board.
     - Open circuit between pin ㉕ and remote control terminal pin 7.
     - The "VCR" is faulty.
   - Trigger signal is absent at pin ㉘ on circuit board (High voltage in play/rec. mode, low in stop mode)
     - Open circuit in camera cable.
     - Camera trigger switch is defective.
   - The voltage at pin ㉙ on circuit board is low when the "VCR" is in the rewind mode, high in all other modes. —— The "VCR" is faulty.
   - X4 – X7, IC2 is faulty.

REPACKING





EXPLODED VIEW


54
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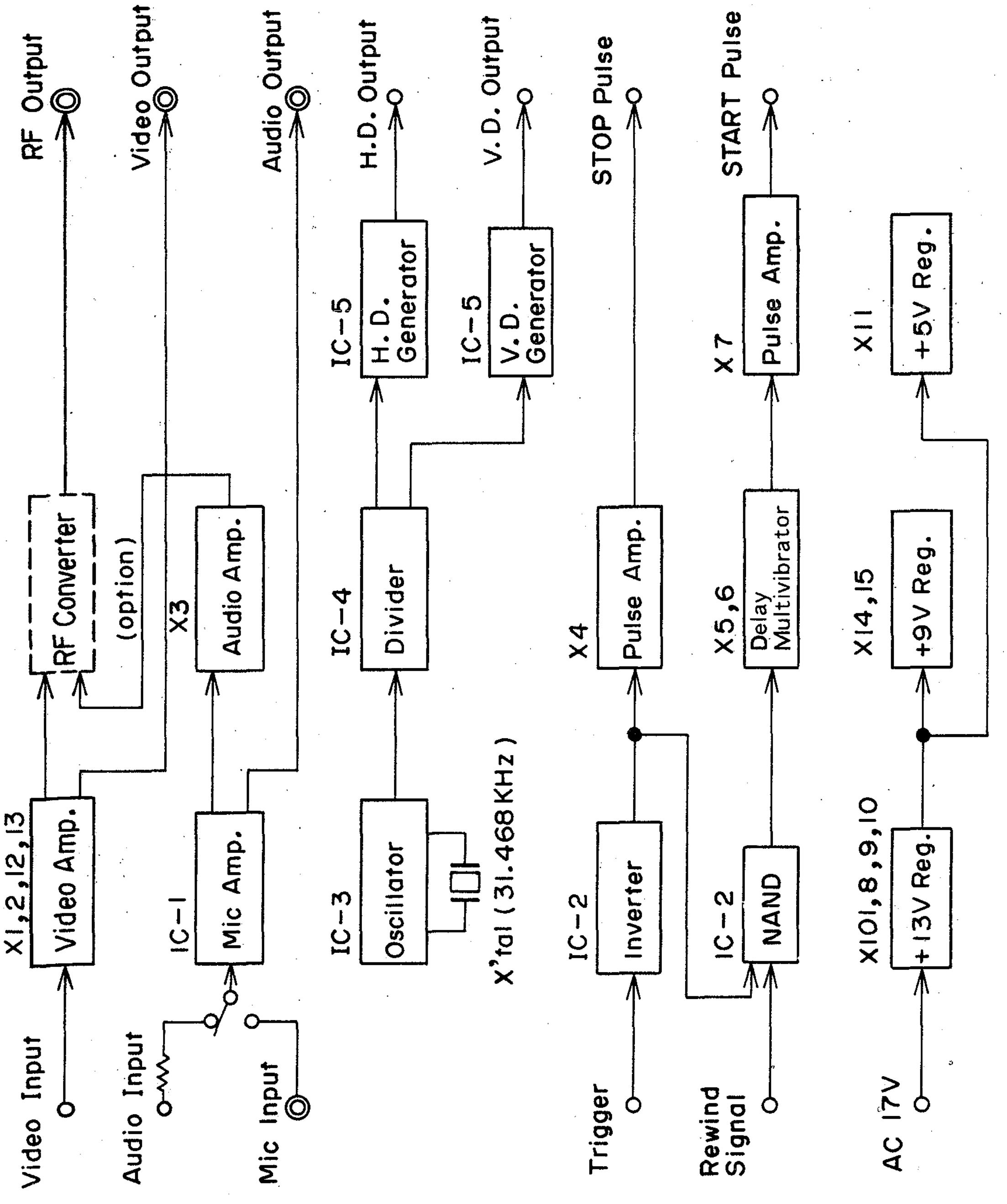
69
38

MECHANICAL PARTS LIST

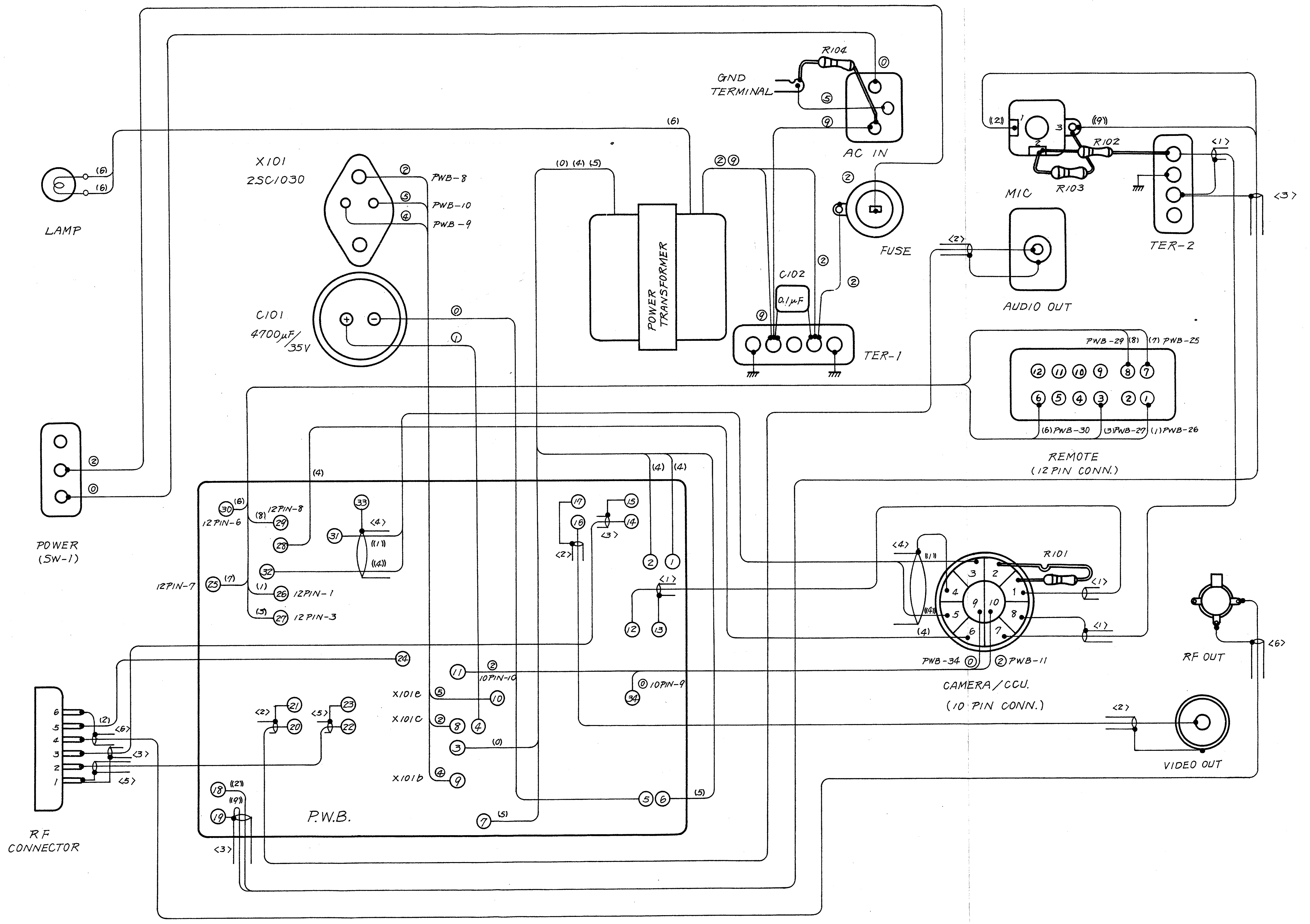
Symbol No.	Part No.	Part Name	Description
1	PU42932	Handle	
2	PU42933	Handle cover	
3	PU20330-2	Cover	
4	PU43391	Bushing	
5	PU40790	Heat sink bracket	
6	PU42941	〃	
7	PU30857	Heat sink	
8	2SC1030	Transistor	
9	PU42127	Insulater	
10	QEY3511-021	Electrolytic capacitor	C101, 4700/35
11	PU30855	Power transformer	
12	PU20328-4	Front panel	
13	54130	Pilot lamp cover	
14	PU40312	Lamp bracket	
15	QLP1004-002	Pilot lamp	
16	QLS1000-002UB	Lamp socket	
17	QSU1213-002	Power switch	
18	PU20327D	Chassis base ass'y	
19	PU45160	Connector	
20	QML1310-043	Lug strip ass'y	
21	QMS6303-002	Microphone jack	
22	T0401-5	Insulator	
23	PU42930	Audio out terminal	
24	QMS35 -001	RF out terminal	
25	PU42949	Insulator	
26	GU45801	CCU connector terminal	
27	GU45073-2	Video connector	
28	GU20125-41-12	Remote connector	
29	QMC0336-001	AC connector	
30	50388	Lug	
31	QMG0201-001	Fuse holder	
32	QMF61U1-1R5	Fuse	1.5A
33	PU20329-4	Rear panel	
34	PU42928A	PWB ass'y	
35	PU40313	Bracket	
36	QFH72EM-104	MM capacitor	C102
37	QML1310-054	Lug strip ass'y	
38	PU42948	Fiber board	
39	QZF1510-002	Foot	
40	QFM41HK-102	Mylar capacitor	C103
41	QRD141K-224	Carbon resistor	R102
42	QRD143J-750	〃	R101
43	PU30457-11	Serial No. Plate	
44	SPSP2008BS	Screw	
45	SPSP2610Z	〃	
46	LPSP3006ZS	〃	
47	SDBP3006RS	〃	
48	SPSP3006FS	〃	
49	SSSP3006ZS	〃	
50	SPSP3008ZS	〃	

Symbol No.	Part No.	Part Name	Description
51	LPSP3008ZS	Screw	
52	LPSP3010ZS	〃	
54	SSBP4015RS	〃	
55	SPSP5008ZS	〃	
56	NNB2000NS	Nut	
57	NNB3000NS	〃	
58	NNS3000NS	〃	
59	NNS4000ZS	〃	
60	NNS5000NS	〃	
61	NNB8000NS	〃	
62	WLS3000N	Lock washer	
63	WNS3000N	Washer	
64	WLS5000N	Lock washer	
65	WNS5000N	Washer	
66	WBS8000N	〃	
67	Q03093-404	Nylon washer	
68	QRD121K-275	Carbon resistor	R104 2.7MΩ ½W
69	SDBP3012NS	Screw	
70	SPBP3010RS	〃	
71	BYS3006BS	〃	

Block Diagram


Video Input
Audio Input
Mic Input
X1,2,12,13
Video Amp.
IC-1
Mic Amp.
RF Converter
(option)
X3
Audio Amp.
RF Output
Video Output
Audio Output
IC-3
Oscillator
X'tal (31.468KHz)
IC-4
Divider
IC-5
H. D.
Generator
IC-5
V. D.
Generator
H.D. Output
V. D. Output
Trigger
IC-2
Inverter
X4
Pulse Amp.
STOP Pulse
Rewind
Signal
IC-2
NAND
X5,6
Delay
Multivibrator
X7
Pulse Amp.
START Pulse
AC 17V
X101,8,9,10
+13V Reg.
X14,15
+9V Reg.
X11
+5V Reg.

Wiring Diagram


LAMP
POWER (SW-1)
RF CONNECTOR
X101 2SC1030
PWB-8
PWB-10
PWB-9
C101 4700μF/35V
POWER TRANSFORMER
C102 0.1μF
TER-1
GND TERMINAL
R104
AC IN
FUSE
MIC
R102
R103
TER-2
AUDIO OUT
REMOTE (12 PIN CONN.)
PWB-29
PWB-25
PWB-30
PWB-27
PWB-26
CAMERA/CCU. (10 PIN CONN.)
R101
PWB-34
PWB-11
RF OUT
VIDEO OUT
P.W.B.
12PIN-6
12PIN-8
12PIN-7
12PIN-1
12PIN-3
10PIN-10
10PIN-9
X101e
X101c
X101b

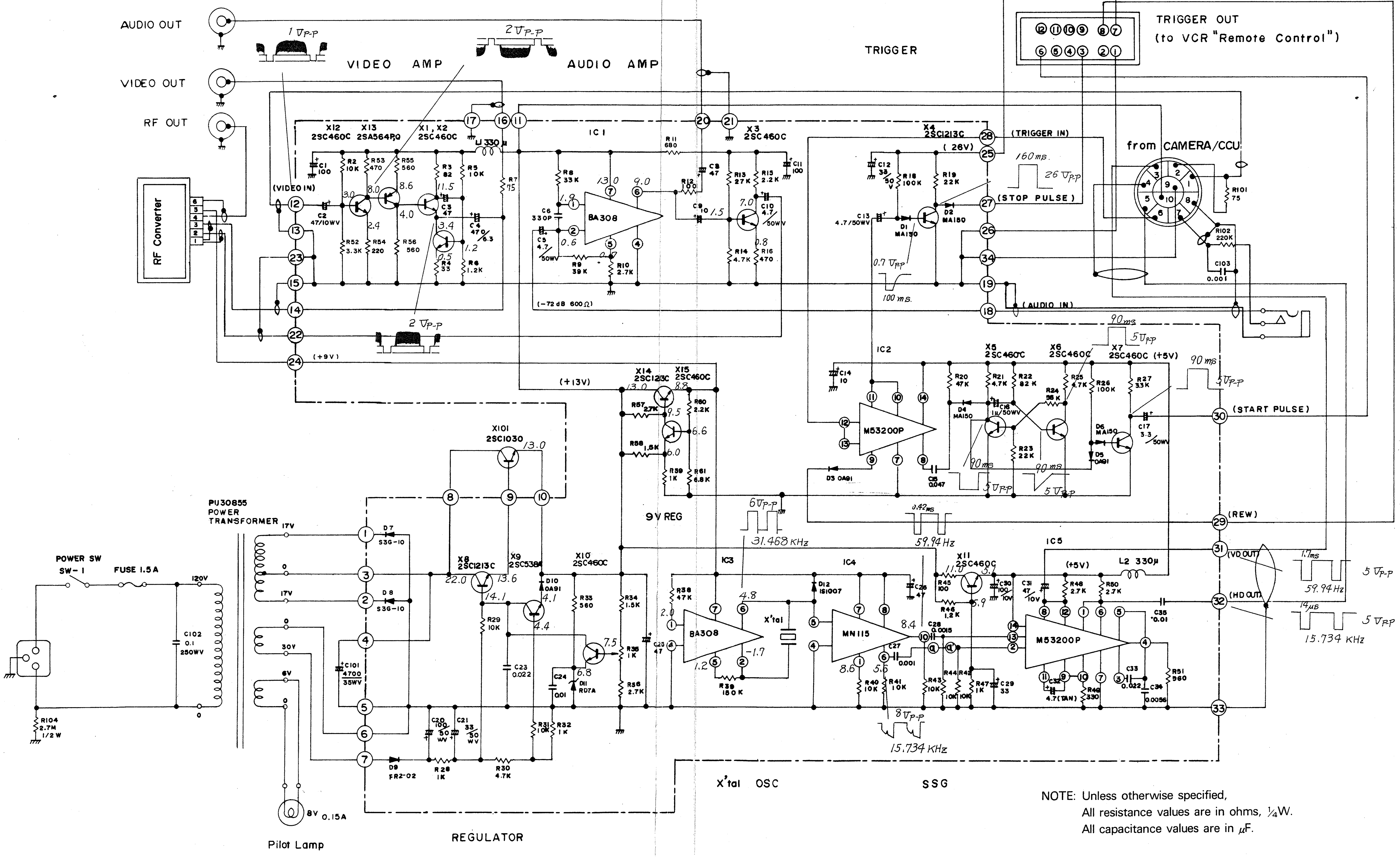
NOTE 1. ⓪ ~ ⑨ ; Q04100 UL/CSA VINYL WIRE'S COLOR CODE

(0) ~ (9) ; Q04096 UL/CSA VINYL WIRE'S COLOR CODE

<0> ~ <9> ; SPAGHETTI'S COLOR CODE

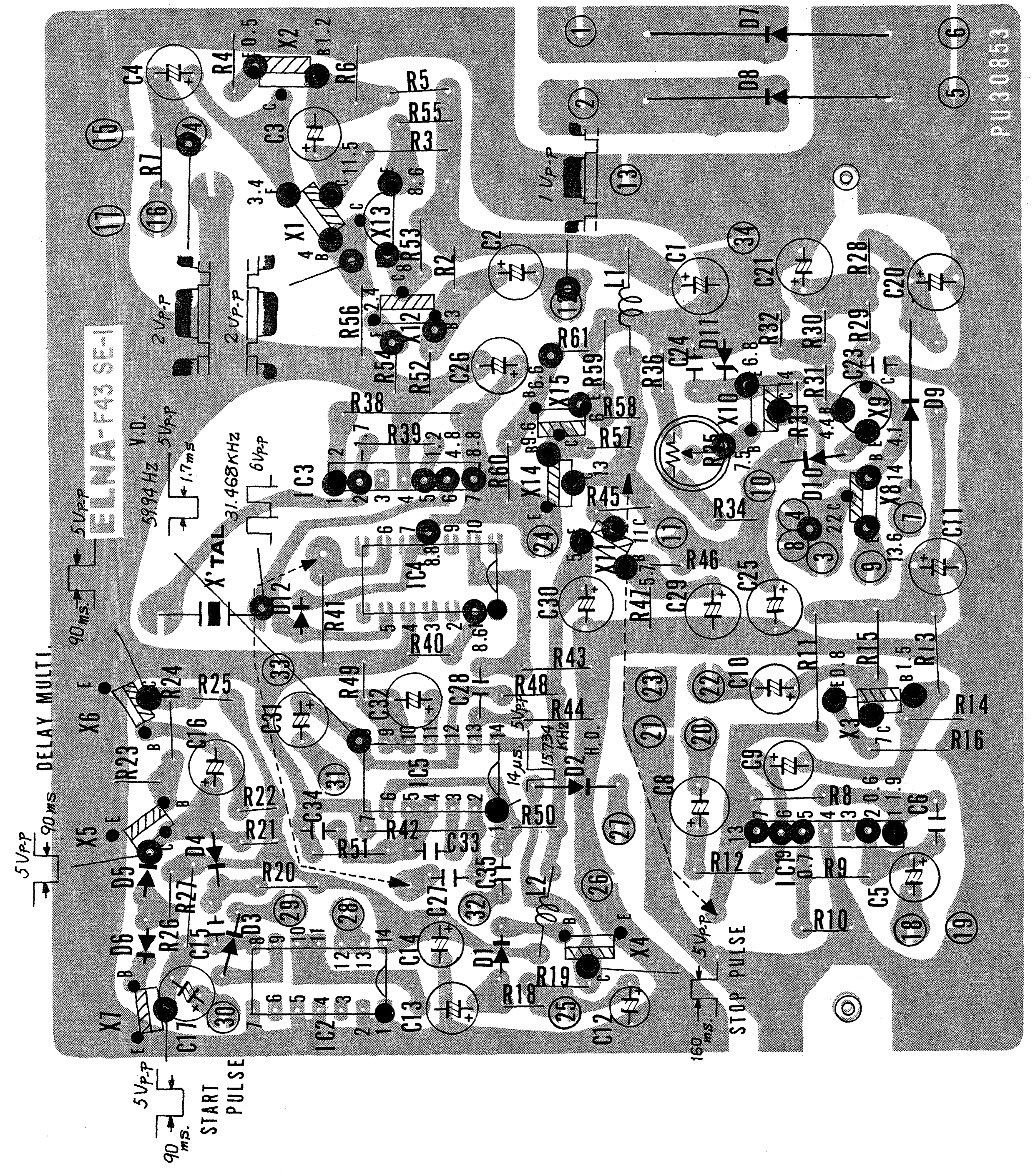
((0)) ~ ((9)) ; CORE WIRE'S COLOR CODE

Schematic Diagram


AUDIO OUT
VIDEO OUT
RF OUT
RF Converter
VIDEO AMP
AUDIO AMP
TRIGGER
TRIGGER OUT
(to VCR "Remote Control")
from CAMERA/CCU
1 Vp-p
2 Vp-p
X12 2SC460C
X13 2SA564PQ
X1, X2 2SC460C
X3 2SC460C
X4 2SC1213C
IC1
BA308
(-72 dB 600Ω)
(VIDEO IN)
(+9V)
(+13V)
(TRIGGER IN)
(26V)
(STOP PULSE)
(AUDIO IN)
(START PULSE)
(REW)
(VD OUT)
(HD OUT)
160 ms
26 Vp-p
0.7 Vp-p
100 ms
90 ms
5 Vp-p
IC2
M53200P
X5 2SC460C
X6 2SC460C
X7 2SC460C (+5V)
X14 2SC1213C
X15 2SC460C
9V REG
X101 2SC1030
PU30855 POWER TRANSFORMER
POWER SW SW-1
FUSE 1.5A
120V
17V
30V
6V
C102 0.1 250WV
R104 2.7M 1/2W
X8 2SC1213C
X9 2SC538A
X10 2SC460C
D7 S3G-10
D8 S3G-10
D9 FR2-02
D10 OA91
D1 RD7A
C101 4700 35WV
6 Vp-p
31.468 KHz
0.42 ms
59.94 Hz
IC3
BA308
X'tal
IC4
MN115
IC5
M53200P
X11 2SC460C
L2 330μ
(+5V)
8 Vp-p
15.734 KHz
1.1 ms
5 Vp-p
59.94 Hz
14 μs
5 Vp-p
15.734 KHz
8V 0.15A
Pilot Lamp
REGULATOR
X'tal OSC
SSG

NOTE: Unless otherwise specified,
All resistance values are in ohms, ¼W.
All capacitance values are in μF.

Circuit Board


ELNA-F43 SE-I
PU30853
DELAY MULTI.
START PULSE
STOP PULSE
X'TAL
59.94 Hz V.D.
31.468KHz
15.734 KHz H.D.
90ms
160ms
1.7ms
14μs
5Vp-p
6Vp-p
2Vp-p
1Vp-p
IC1
IC2
IC3
IC4
IC5
X1
X2
X3
X4
X5
X6
X7
X8
X9
X10
X11
X12
X13
X14
X15
D1
D2
D3
D4
D5
D6
D7
D8
D9
D10
D11
D12
L1
L2

ELECTRICAL PARTS LIST

Abbreviations in this list are as follows:

RESISTORS — All resistance values are in ohms (Ω).

K : 1,000
M : 1,000,000
CR : Carbon Resistor
Comp. R : Composition Resistor
WR : Wire Wound Resistor
OMR : Oxide Metal Film Resistor
VR : Variable Resistor
MFR : Metal Film Resistor

CAPACITORS — All capacitance values are in μF, unless otherwise indicated.

P : μμF
C Cap : Ceramic Capacitor
PS Cap : Polystyrol Capacitor
MY Cap : Mylar Capacitor
MP Cap : Metalized Paper Capacitor
PC Cap : Polycarbonate Capacitor
E Cap : Electrolytic Capacitor
PP Cap : Poly Pro Capacitor
MM Cap : Metalized Mylar Capacitor
T Cap : Tantalum Capacitor

Tolerances of resistors or capacitors are as follows:

M : ± 20%
K : ± 10%
J : ± 5%
G : ± 2%

Symbol No.	Part No.	Part Name	Description
	PU42928A	Camera adapter PWB ass'y	
	PU30853	Camera adapter PWB	
X 1	2SC460C	Transistor	
X 2	"	"	
X 3	"	"	
X 4	2SC1213C	"	
X 5	2SC460C	"	
X 6	"	"	
X 7	"	"	
X 8	2SC1213C	"	
X 9	2SC538A	"	
X10	2SC460C	"	
X11	"	"	
X12	"	"	
X13	2SA564P	"	(or 2SA564Q)
X14	2SC1213C	"	
X15	2SC460C	"	
IC 1	BA308	Integrated circuit	
IC 2	M53200P	"	SN7400N
IC 3	BA308	"	
IC 4	MN115	"	or MN117
IC 5	M53200P	"	SN7400N
D 1	MA150	Diode	
D 2	"	"	
D 3	OA91	"	
D 4	MA150	"	
D 5	OA91	"	
D 6	MA150	"	
D 7	S3G-10	"	
D 8	S3G-10	"	
D 9	SIB01-02	"	
D10	OA91	"	
D11	RD7AM	"	
D12	1S1007	"	
R 1	—		—
R 2	QRD143K-103	C.R.	10K, ¼W, K
R 3	" -820	"	82, "
R 4	" -330	"	33, "
R 5	" -103	"	10K, "
R 6	" -122	"	1.2K, "
R 7	" -820	"	82, "
R 8	" -333	"	33K, "
R 9	" -393	"	39K, "
R10	" -272	"	2.7K, "
R11	" -681	"	680, "
R12	" -101	"	100, "
R13	" -273	"	27K, "
R14	" -472	"	4.7K, "
R15	" -222	"	2.2K, "
R16	" -471	"	470, "
R17	—		—
R18	QRD143K-104	C.R.	100K, ¼W, K
R19	" -223	"	22K, "
R20	" -473	"	47K, "
R21	" -472	"	4.7K, "
R22	" -823	"	82K, "
R23	" -223	"	22K, "

Symbol No.	Part No.	Part Name	Description
R24	QRD143K-563	C.R.	56K, ¼W, K
R25	" -472	"	4.7K "
R26	" -104	"	100K, "
R27	" -332	"	3.3K "
R28	" -102	"	1K, "
R29	" -103	"	10K "
R30	" -472	"	4.7K "
R31	" -103	"	10K "
R32	" -102	"	1K "
R33	" -561	"	560 "
R34	" -152	"	1.5K, "
R35	QVP4A0B-102	V.R.	1K
R36	QRD143K-272	C.R.	2.7K ¼W, K
R37	—		—
R38	QRD143K-473	C.R.	47K, ¼W, K
R39	" -154	"	150K, "
R40	" -103	"	10K, "
R41	" -103	"	10K, "
R42	" -103	"	10K, "
R43	" -103	"	10K, "
R44	" -103	"	10K, "
R45	" -101	"	100, "
R46	" -122	"	1.2K, "
R47	" -102	"	1K, "
R48	" -272	"	2.7K, "
R49	" -331	"	330, "
R50	" -272	"	2.7K, "
R51	" -561	"	560, "
R52	" -332	"	3.3K, "
R53	" -471	"	470, "
R54	" -221	"	220, "
R55	" -561	"	560, "
R56	" -561	"	560, "
R57	" -272	"	2.7K, "
R58	" -152	"	1.5K, "
R59	" -102	"	1K, "
R60	" -222	"	2.2K, "
R61	" -682	"	6.8K, "
C 1	QEW41CA-107	E. Cap	100, 16V
C 2	QEW41AA-476	"	47,10V
C 3	QEW41CA-476	"	47, 16V
C 4	QEW40JA-477	"	470, 6.3V
C 5	QEW41HA-475	"	4.7, 50V
C 6	QCS11HJ-331	C. Cap	330p, "
C 7	—		—
C 8	QEW41CA-476	E. Cap	47, 16V
C 9	" -106	"	10, "
C10	QEW41HA-475	"	4.7, 50V
C11	QEW41CA-107	"	100, 16V
C12	QEW41HA-336	"	33, 50V
C13	" -475	"	4.7, "
C14	QEW41CA-106	"	10, 16V
C15	QFM41HK-473	MY Cap	0.047, 50V
C16	QEW41HA-105	E. Cap	1, "
C17	" -335	"	3.3 "
C18	—	—	—
C19	—	—	—
C20	QEW41HA-107	E. Cap	100, 50V
C21	" -336	"	33, "
C22	—	—	—
C23	QFM41HK-223	MY Cap	0.022.50V

Symbol No.	Part No.	Part Name	Description
C24	QFM41HK-103	MY Cap	0.01, 50V
C25	QEW41CA-476	E. Cap	47, 16V
C26	" -476	"	47, "
C27	QFM41HK-102	MY Cap	0.001, 50V
C28	" -152	"	0.0015, "
C29	QEW41AA-336	E. Cap	33, 10V
C30	" -107	"	100, "
C31	" -476	"	47, "
C32	QEE41CM-475	T. Cap	4.7, 16V
C33	QFM41HK-223	MY Cap	0.022, 50V
C34	" -562	"	0.0056, "
C35	" -103	"	0.01, "
L 1	A04096-330	Peaking coil	330μH
L 2	" -330	"	"
	PU30789	Crystal	
	PU40051	Rubber band	
	GA40086	Holder	